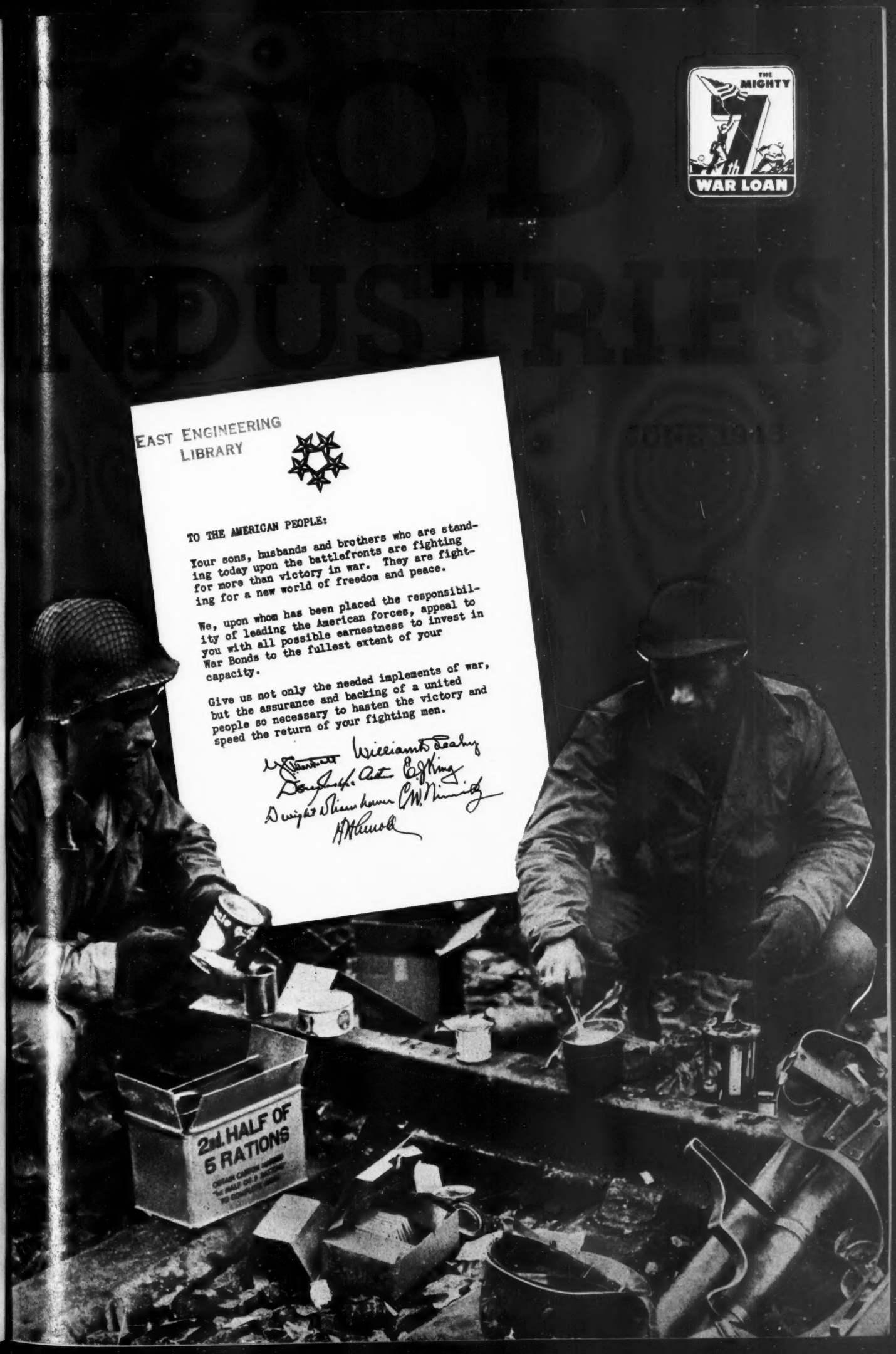
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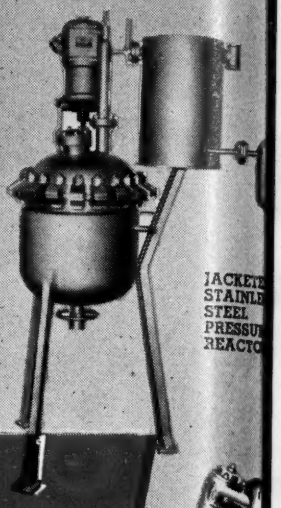

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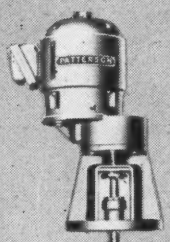

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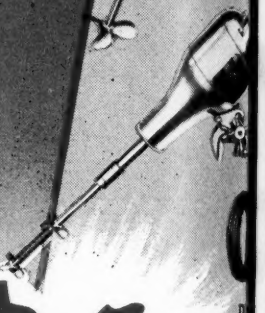

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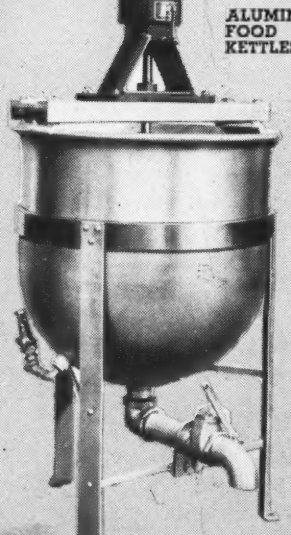

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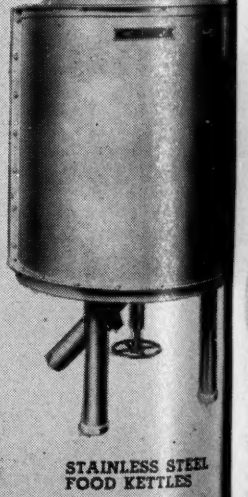

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THE COVER

We present on the cover of this issue an important message to you from the seven 5-star generals and admirals. If you haven't already read it, turn back and do so. Lending emphasis to the message is a picture of two American infantrymen having chow on a railroad track near the front lines in Belgium. Back them up with bonds.

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PUBLICATION OFFICE: 310 S. Desplaines St., Chicago 6, Ill. Return postage guaranteed.

EDITORIAL AND EXECUTIVE OFFICES: 330 West 42nd St., New York 18, N. Y. (Address correspondence here.)

BRANCH OFFICES: 520 North Michigan Ave., Chicago 11; 68 Post St., San Francisco 4; 739-9 Oliver Bldg., Pittsburgh 22; Aldwych House, Aldwych, London, W.C. 2; Washington 4; Philadelphia 2; Cleveland 15; Detroit 2; Los Angeles 14; St. Louis 1; Boston 16; Atlanta 3.

JAMES H. McGRAW JR., President; CURTIS W. McGRAW, Senior Vice-President and Treasurer; HOWARD EHRLICH, Vice-President (for business operations); JOHN ABBINK, Vice-President (for editorial operations); JOSEPH A. GERARDI, Secretary, and J. S. BLACKBURN, Jr., Director of Circulation.

CABLE ADDRESS: "McGRAW-HILL, N. Y." Member A.B.P. Member A.B.C. Contents indexed monthly in Industrial Arts Index.

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What V-E Means to Food Industry

VICTORY IN EUROPE has increased the demand for food at a time when the domestic food situation is at its worst since the war started. So V-E Day has made even more necessary than before a strong one-man management of the food problems of the nation. But it also has eased the restrictions on some materials and equipment needed for the production, processing and distribution of food. Given a food czar who will take into account the needs of the industry for raw materials, equipment and repair parts and manpower—and who will then take appropriate action—much can be done to ease the food situation, at least on a long-range basis.

The need for a strong food administration has been recognized by President Truman in his appointment of Representative Clinton P. Anderson as Secretary of Agriculture, his move to put WFA under the Secretary and his plan to give WFA more say in the food-pricing activities of OPA. These are constructive moves. However, there is a big job ahead of the new Secretary.

Prospects for Processors

But what does victory in Europe mean for the individual food processor? For one thing, he faces no problem of reconversion, since there was no marked conversion in the food industry to meet war demands. With minor exceptions, the change from a prewar production to a wartime basis was largely one of increased production rates or of stepped-up production capacities. Until the war with Japan ends and the rest of the world gets back to a self-feeding basis, there is little likelihood of a lessening in the need for full production of processed foods.

With the cutbacks in the production of munitions, planes and ships come far-reaching effects as far as the processing of foods is concerned. Of first importance is the gradual increase in available labor, equipment materials and ingredient and packaging supplies. All are now greatly needed. Second will be the filling of equipment orders—estimated, at present, to amount to from one to three year's production of existing capacity and to have a value of $600,000,000 for replacements alone. Also will come a gradual but general adoption of new methods of processing and of ways of meeting production schedules as new and redesigned production equipment, packaging materials, containers, and ingredient supplies adopted or developed to meet the armed forces' requirements become available for general use.

These reassuring factors have some less encouraging counterparts. Even though 1,300,000 men (net) are released from the armed forces and another 5,000,000 dropped by the war industries within the coming year, there is the problem of getting the needed seasonal labor to meet present and summer peak-season needs for sugar beet production and for the harvesting and processing of the canning and freezing crops. These two instances are only examples. To meet the potential shortage of more than a half-million seasonal workers, procedures and practices used last year will have to be repeated.

The Materials Situation

The container situation appears none too good. WPB-reported stocks of refined tin had dropped to 70,000 tons by the end of April, the lowest since Pearl Harbor and a third less than was in the 1942 stockpile. With detinning plants now operating at only 50 percent of capacity, because of disappointingly low salvage of used tin cans, the present rate of tin consumption will exhaust the existing stockpile before Far East imports can be resumed. The only apparent relief, if any, is an increased rate of supply from Western Hemisphere sources. Rate of use may even increase because of the demand for tin containers for rehabilitation areas.

The paper container picture is not materially brightened by the possibility of wood pulp imports from abroad. The change is more likely to be in quality rather than quantity.

Raw materials, particularly sugar, fats and oils, will continue to be scarce, even to the point of necessitating additional formula adjustments and rationing of foods in which they are essential ingredients.

Railroad transportation will not improve in total volume of traffic although there will be marked changes in direction of traffic towards Pacific ports. Truck transportation will ease as more tires, repair parts and gasoline—perhaps even trucks—become available with the shift-over in industrial production.

Food processing, of all the manufacturing industries, will continue to hold top place in our war program until the Japs are defeated.

M. A. Williamson
PUBLISHER

The Talk of the Industry

• RESEARCH EXECUTIVES of a large food company were surprised some years ago when they discovered that about 15 percent of the bill for raw materials went for packaging materials, yet less than 2 percent of the research appropriation was spent on packaging research. This seemed out of proportion and the company set about correcting the situation. A good many more executives would be surprised if they made a similar check on the magnitude of their packaging research. In fact, many of them would find no package research whatever.

• ONE food company, as reported elsewhere in this issue, plans to spend fifty to seventy-five million dollars in the first five postwar years to expand its processing and distribution facilities. Here is postwar planning carried through from the "p" to the "g," the only kind that will pay dividends. Talk is cheap and dreams are wonderful, but your customers can't eat them, nor your stockholders put them in the bank.

• UNITED AIRLINES recently flew 6,187 lb. of asparagus from Stockton, Calif., to Cleveland. Picked on a Saturday, it left California at 6 p.m., Sunday, arrived in Cleveland at noon Monday and went on sale Tuesday as "air-shipped" asparagus—at a 37 percent price premium. On the first day 71 percent of it was sold, the remainder the next day. United will not reveal the freight rates, as this was an experimental shipment. But it would seem that there is some possibility that air transport eventually may chart the way to new "luxury" markets for fresh vegetable shippers.

• IN the 60-year period from 1880 to 1940, the average production per nonagricultural worker increased from 5 to 22 tons. In the same period, the electrical energy put behind each worker was stepped up from 4/5 to 4½ hp. There you have a fundamental factor in raising the standard of living from the horse-and-buggy level to a plateau of abundance where automobiles, radios, electric refrigerators and processed foods are every-home commonplaces. Tomorrow's factories will use more than 4½ electrical horses to speed the production of the worker. As a means of attaining cost-cutting efficiency, it is always best policy not to use manpower where horsepower can be kept reasonably busy.

• INSTITUTED as a wartime conservation measure, the every-other-day delivery of fluid milk has resulted in an economy which has helped to absorb increased costs in other phases of the fluid milk business. Preservation of this and other economies is considered essential after the war, if prices to consumers are to be kept down. And without this lower distribution cost for home-delivered products, Borden's President Montague considers it very doubtful whether that service can be maintained in large cities in postwar years. Otherwise, prices would have to be much higher to cover the increased distribution cost, and volume of sales might easily diminish to a point which would make continuance of home delivery impossible.

Now all somebody has to do is get the milkmen's unions to agree to every-other-day delivery after the war. Given a choice of that or nothing, one would think they would see the light, but labor leaders often wear smoked glasses.

• PREOCCUPATION with the progress of the war has possibly diverted our attention from the doings of Consumers Research and Consumers Union. Yet, if memory serves, neither has had much to say of late about branded merchandise. Can this omission be properly construed as dereliction of duty? Or is it possible that executives or these organizations are paying their dimes for a plain paper bag—alleged to contain ten cigarettes—and considering themselves lucky?

Hors d'Oeuvres

• Headline: Prisoners of War Cut to Three Meals a Day.—How awful.

• *In the last 100 years the world's population has more than doubled, according to the most reliable data available, increasing to 2,169,000,000 in 1945. Who say's the food business is static?*

• In the crop year 1931-32, per capita consumption of canned fruit was 11.07 lb., of vegetables, 16.02 lb. By 1941, the figures had jumped to 19.30 for fruits and 38.60 for vegetables. Quick freezing is by no means the only up and coming food business.

• *Thanks to blackmarket prices for poultry, the laying stock has been so depleted that a shortage of eggs is predicted in the months ahead. Just another case of greed killing the fowl that lays the golden egg.*

• Seed potatoes are to be shipped to remote areas of the world in the form of dehydrated potato chips, with at least one eye per chip, to save 90 percent in shipping weight. Is a new market sprouting for the dehydrators?

• *A Smithfield ham cured in 1902 by P. D. Gwaltney, Jr., & Co. is insured against fire and theft for $5,000. It's nice to know that somewhere in the country there is one whole ham.*

• A few enterprising companies are now selling frozen pies, and cakes for the customer to bake in her own oven. Now the hostess can brag about her home baking with a clear conscience.

• *Tex Roden, president of American Home Foods, Inc., is out with his third mystery thriller, "One Angel Less." Some executives encounter all the mystery they want in the food business, but not Tex.*

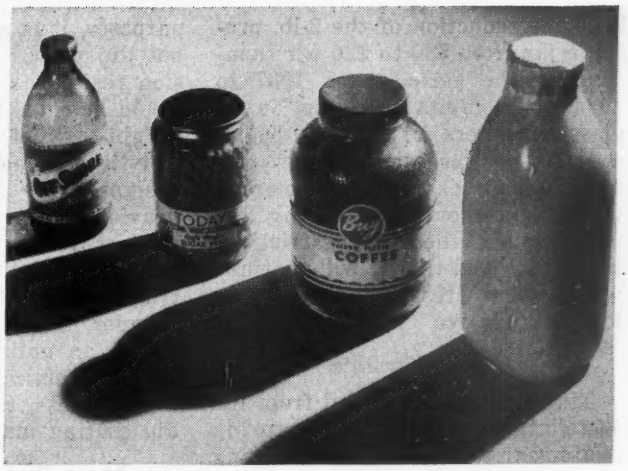
• You can judge the value of a laying hen by the appearance of her eyes, the eye being yellow around the outside for a poor layer. Well, the experts have always picked their chicks by the look in their eyes.

• *A man out in Illinois stipulated in his will that when he died his ashes were to be put into a tomato can and buried beside the bodies of his two pet dogs. Since modern man lives largely out of a can he might just as well go to Heaven out of one.*

• Portable flour mills are being used as emergency equipment in devastated Europe. We hope the big wheat farmers don't get any ideas from this and hitch portable mills to their combines.

F. K. L.

Improvements in heavy fiberboard shipping containers and in can lacquers mean better service on the home market.



Lighter, stronger and lower cost glass containers are now available for beer and processed foods.

What's New in Package Materials

There have been several developments of postwar significance in papers, glass, tinplate, coatings, wrapping materials and fiber boxes. These were reviewed by six authorities at a symposium on May 3. The highlights are presented here

ASPECTS of the container problem that are of immediate and future importance to the food industries were presented by a group of experts in their several fields to the New York Section of the Institute of Food Technologists on May 3.

Papers Improved

F. S. Leinbach, assistant to the general manager of the Riegel Paper Corp., who discussed the paper situation, anticipates that a gradual improvement will start at an indeterminate time after V-E day even though the somewhat lessened war demand will be offset by rehabilitation requirements. Difficulties within the industry have been brought about because the short pulp supply has forced mills that normally depend on wood pulp to go over to waste paper. As foreign pulps gradually become available this dislocation can be corrected. Results, which may possibly be seen in the 4th quarter of 1945, will include a somewhat better supply of paper, much better delivery service from the mills and a closer approach to prewar quality standards.

Through recent developments in manufacturing technic, the food packager will have cleaner, stronger, whiter papers postwar. New production is tending toward kraft (sulphate), with more effective bleaching of both sulphate and sulphite pulps.

However, a big advance has come because the paper technologist has learned to use the products of other industries to modify and to amplify the qualities of paper. Of particular interest to the food technologist is the fact that wet strength can now be obtained as an addition to the other properties of familiar papers. That is, wet strength can be added to the high strength of kraft, the good appearance and printability of sulphite, or the greaseproof and moistureproof properties of glassines. New modified wax coatings are tougher. Lacquers and special coatings are being more widely applied. Heat sealing will be adopted more generally as a convenient means of closing packages. Interesting new "paper" uses are arising from combinations of paper and such products as the synthetic films or aluminum foil.

But, this speaker said, the greatest advance of all in technic in the paper field has been in the scientific development of the paper technician. He has educated himself to the fundamentals and the requirements of food packaging. He has learned how to measure, both qualitatively and quantitatively, the properties required in food packaging. Now the paper technologist looks to the food technologist to define quantitatively the requirement that the food product places upon its package, so that those in the packaging supply field will be able to do a better job.

Glass Lighter

Glass packaging has come a long way since prewar days, according to H. A. Barnby, director of the Packaging Research Division of Owens-Illinois Glass Co., Toledo, Ohio. The new glass containers are lighter and they are stronger. For instance, the prewar multitrip beer bottle weighed 16 oz., the 1-trip bottle which has traveled so successfully to Africa and to the Pacific weighs 6¼ oz., a 60 percent reduction in weight. Baby food jars, vegetable jars and coffee containers have been reduced to about half the old weight. Even the square milk container, redesigned for convenience, has come down from 22 to 17¾ oz. At the same time, the better architecture of the new designs assures added strength and freedom from breakage. Costs per container have been decreased even during the war. Typical has

been the reduction of the 2-lb. preserve jar from $30 to $20 per thousand in the period from 1937 to 1944. Per capita consumption of glass containers for food had begun a steady upward trend before the war. Indications are that this trend would have continued during the period when the war restrictions intervened and that it will continue when those restrictions are no longer operative.

Better Tinplate

Tin cans have benefited from the installation of new manufacturing equipment just prior to and during the war period, reported F. C. Baselt, manager of research, American Can Co. Continuous mills for rolling strip have reduced operating costs so that it is now economical to use a base metal of lower phosphorus and silicon content, with consequent better corrosion-resisting properties. The product has greater ductility, smoother surface and closer gage tolerances.

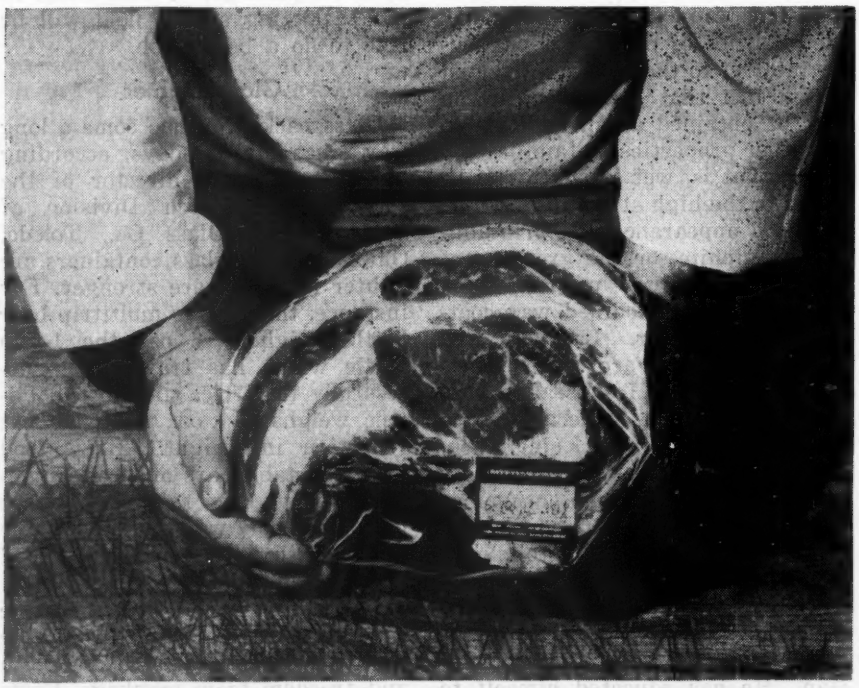
Huge electrolytic tinning lines have supplemented hot-dip equipment. Electrolytic plate is here to stay. The extent of its use will depend on economic considerations and on improvements in its corrosion resistance. Before the war it was used in cans for coffee and other dry products. Now enamel-coated electrolytic plate is superior in rust resistance to standard plain hot dip plate and, for all practical purposes, it is as good as enameled hot dip plate. Probably its corrosion resistance in heavier coatings would be equal to that of the same weight of hot dip, but the electrolytic tinning equipment is not designed for the production of heavier coatings. If for a certain product it has been necessary to use enamel linings in the past, electrolytic tin will be suitable and cheaper. If it has been necessary to use an unlined can in the past, for the chemical protection afforded the contents, then the heavier hot dip coating must be used.

More Protective Coatings

Protective coatings, both for metal and for paper containers, were discussed briefly by Harvey C. Hopkins, general manager of purchases for American Can Co. The great difference in coatings for the two types of bases is due to the fact that maximum resistance to abrasion and chemical action is developed in most organic coatings by baking at temperatures which paper will not stand. Baking temperatures of 300 to 400 deg. F. are frequently necessary to obtain proper adhesion of coatings to sheet metal, while penetration of the coating into paper and paperboard fibers provides sufficient bond.

Prewar protective coatings for metal were generally oil-modified natural or synthetic resins. Added protection was given to products in paper containers through incorporation of resinous sizing materials in the paper; impregnation with asphalt and waxes; or through application of organic coatings, waxes and wax emulsions to the surface of the paper or the finished container. These did not afford sufficient protection for war service in many cases, while lack of raw materials forced replacements of natural drying oils, resins, gums and even solvents. Materials that have been an outgrowth of the resultant intensive development include improved drying oils. Oil-modified synthetic resins that are paler in color will permit more pleasing decorative effects while providing better protection both against action of the product on the container and against the external effects of adverse storage conditions. Waxes have been improved for various functional uses. There has also been a considerable advance in the knowledge of application and use of organic coatings.

The biggest field of development in quantity and in adaptation to specialized uses has been in the straight synthetic resins. Many of these are not yet available for general packaging uses, but a wide variety of resins based on the vinyl compounds, polystyrene, resins of petroleum origin, the acrylate series and the silicones will be available after the war. The speaker concluded that it is quite obvious that we can look forward to a substantial improvement in the performance of containers because of improved protective coatings.



New synthetic films and laminates will be available, but they will not replace the old reliables like cellophane.

New Wrapping Materials

Developments in wrapping materials, discussed by A. F. Wendler, manager of Acetate Films, Cellophane Division, E. I. du Pont de Nemours & Co., Inc., have been largely in the field of laminations. Materials previously considered dissimilar and illogical of combination have been used, and laminations of transparent films to themselves, metal foils, functional papers, cloth and board have been developed. While technical progress has been rapid, it is questionable if these materials have yet reached a state of perfection, either from the standpoint of technical characteristics of the material itself, commercial production on a large-scale basis, stabilized cost to the consumer or—more important to the food technologist—commercial application to the products to be wrapped.

Film use will be divided between

the so-called "old reliables" and some of the new types used by themselves, in combination with previous types, or in the form of new coatings on both the previous standard and the new film-formers.

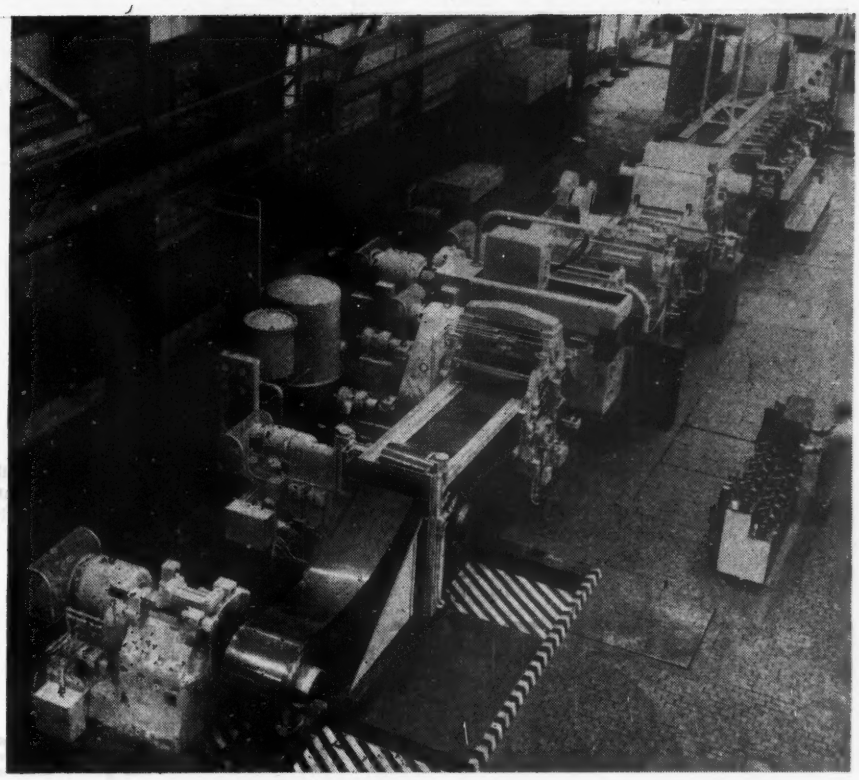
While it is true that the possibilities of these films for the future are almost limitless, it is felt that the established prewar films will return, with improvements, in most of their prewar channels. New type films, available with improvements beyond those now generally known, will be more apt to establish themselves in specialized applications than as wholesale replacements of the established prewar films, thus broadening the field of transparent packaging materials instead of resolving themselves as competitive to the previously established types.

Among the newer developments, partially vacuumized packages are indicated for air transport and high-vacuum flexible packages are already receiving consideration in certain quarters.

The decision for the adoption of a new packaging material should not be based alone upon the characteristics of the wrapper, even though its properties may appear to be ideal. Instead, it should be based upon results obtained from fairly extensive tests made upon commercially wrapped packages of the product itself. It is the combination of product and wrapper which determines the applicability of a packaging medium to a given use. Many an erroneous conclusion has, in the past, been drawn due to lack of proper testing procedure.

While it is not possible at this time to provide a complete list of items to be given consideration, the following are pertinent factors:

The nature of the product, cost, distribution of the product, competition and package turnover or shelf life. Transparency and visibility may be desirable, yet in some instances opacity may be preferable—especially if the effect of light is deleterious. Packaging operations can greatly influence the final decision. With hand operations, the speed of wrapping has a direct bearing on labor requirements and final cost. In machine applications, items such as static, sticking to heater plates, critical sealing temperatures, possible applicability of electronic sealing and speed of operation are important. Similarly, items not to be overlooked are gas and odor transmission, effect of high and low temperatures, permanence of sealed areas under adverse conditions, ease of printing, shipping costs, storage requirements and breakage.



Electrolytic tinplate is here to stay. The roll in the foreground is cold rolled strip steel entering one of the huge new electrolytic tinning lines.

Fiber Box Developments

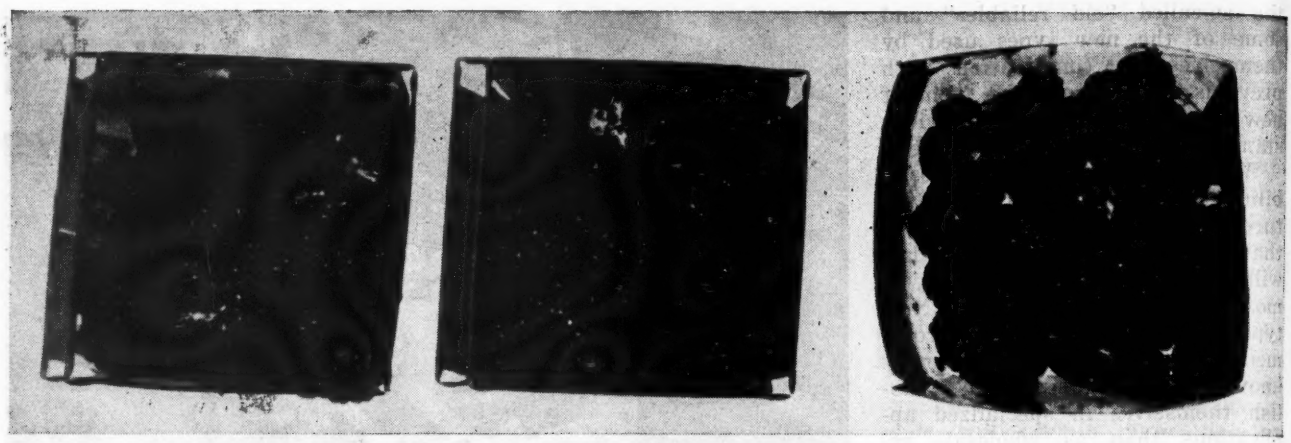
Albert W. Luhrs, industrial consultant, stated that in view of the ever-increasing demands for "V" and "W" boxes for export shipments and the consequent ever-diminishing supply of container materials for use in domestic boxes, there will be a continuance of the present short supply of domestic boxes until at least after the end of the 1945 canning season.

During 1944, approximately 4¼ million tons of paperboard was consumed in making corrugated and fiber boxes, the production approaching the largest in the history of the industry. Although 20 percent of this tonnage was used for the heavy overseas boxes, the number of boxes produced was maintained high by reducing the weight of board in domestic boxes. The food industry uses about 44 percent of all the corrugated and solid fiber boxes manufactured, and, in 1944, approximately 2¼ billion tons was used for food products.

Reduction in specifications for domestic shipment, reuse of containers and restrictions on boxes for some products have helped, but new demands have been made on the fiber box industry through substitution of fiber boxes for wooden cases, either because the latter were unavailable, or, in some cases, because fiberboard offers greater protection to the contents.

The average monthly production of "V" and "W" boxes during the year 1944 was 68,000 tons. An all-time high of 96,000 tons was reached in March, 1945. The estimated requirements for the second quarter of 1945 are 125,000 tons per month. Since the total production of all kinds of fiber boxes cannot be increased because no additional supplies of kraft pulp and fiberboard are available, it is apparent that the production of domestic boxes must be further curtailed.

Some unexpected problems have developed in the use of fiber boxes. For instance, an unusual type of corrosion on cans packed in solid fiber V-boxes proved to be due to fiberboard containers with high moisture content and no asphalt barriers. The board had been laminated with a urea-formaldehyde adhesive containing an ammonium chloride catalyst. Since then, practically all V-boxes for canned foods have one or two asphalt barriers in the board. It is considered inadvisable to pack cans in boxes having a moisture content over 12 percent.



Effect of sodium propionate treatment on youngberries held for four days at 75 to 77 deg. F. Berries in box at extreme right were not treated. Box at left was treated with a 10 percent spray; that second from left, with a 10 percent dip; that third from left, with a 5 percent dip. Treated samples show some mold, but untreated sample molded badly.

Propionates Control Microbial Growth in Fruits, Vegetables

By E. R. WOLFORD and A. A. ANDERSEN
Western Regional Research Laboratory, Albany, Calif.*

Propionate treatment of figs and berries appreciably retards development of mold. Treatment of shelled peas and lima beans maintains quality longer during delay between harvesting and processing. Effect varies with pH

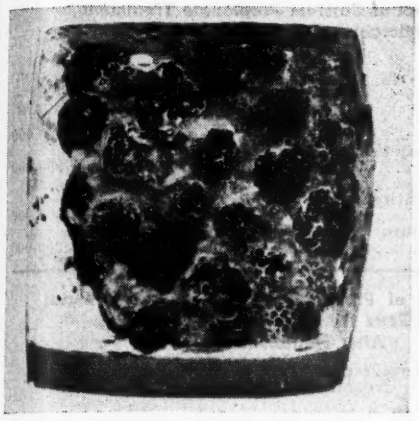
DATA presented here indicate that the propionate treatments of figs and berries appreciably retarded the development of mold. No evidence was observed that in raw fruit the normal physiological processes, ending in over-ripeness, are slowed by propionate. The beneficial effect of propionate on shelled peas and lima beans—amounting to several additional hours of maintenance of good quality in the delay between harvesting and processing—is of significance, because these commodities are nearly neutral in pH and their deterioration is primarily bacterial rather than fungal in nature. The practical application of propionate is not sharply confined to acid foods or to the suppression of only a few forms of microbial life. Treatment must not, of course, be considered a cure-all or a license to become lax in the handling of produce during the harvest-to-processing delay. It may be used to advantage during harvest peaks when crops may ripen at rates beyond the capacity of the plant to handle them, and when bacteriological problems resulting from high temperatures and long delays are most likely to be encountered.

Interest in chemical compounds that check microbial growth has led to the use of several preservatives in food products and also to research on their mode of action and their effect on foods. The experimental work reported here has been concerned with the action of propionates on various microorganisms in pure culture and also with the effectiveness of propionates in delaying spoilage of fresh fruits and vegetables. It was undertaken because of the need in the food industries for a means of reducing losses that frequently occur as a result of microbial activity in fresh commodities.

In a study on the effect of sodium benzoate on various yeasts, molds and bacteria, Cruess and Richert (1929) showed the organisms are more sensitive in the pH range of 2.5 to 4.5 than when the medium is more nearly neutral. Smaller amounts of benzoate are thus needed to stop microbial growth at pH 2.5 to 3.5 than at pH 5.0 to 6.0, as was demonstrated by Cruess and Irish (1932), who also found the same to be true for benzoic, sulphurous, salicylic and acetic acids. The same investigators found that the preservative action of organic acids is different from that of sodium chloride and that the action of the acids depends upon the concentration of undissociated acid, whereas salt is effective through the changes it brings about in osmotic pressure.

The effect of passage of undissociated molecules through cell membranes has been investigated by numerous workers. Osterhout (1925), for example, investigated the entrance of hydrogen sulphide into cells of *Valonia macrophysia* and found that little or no hydrogen sulphide entered the cell except as undissociated molecules. More recent work has been reported by Rahn and Conn (1944), who point

*Bureau of Agricultural and Industrial Chemistry, Agricultural Research Administration, U. S. Department of Agriculture.



out that cell membranes are relatively more resistant to the passage of ions than to the passage of undissociated molecules. Thus, under acid conditions, the undissociated molecules of a weak acid are relatively more abundant and exert a more pronounced effect on microorganisms. Hoffman, Schweitzer and Dalby (1939) showed that fatty acids with 1 to 14 carbon atoms in the molecular chain exert an inhibiting action on several common molds, which varies with chain length, acid concentration and pH of the medium.

Although the use of calcium and sodium salts of propionic acid has increased in recent years, technical literature on the subject is rather scant. O'Leary and Kralovec (1941) reported that "ropiness" in bread, caused by the growth of *Bacillus mesentericus*, can be prevented by the addition of 0.188 percent of calcium propionate to bread dough at pH 5.8 or by 0.156 percent at pH 5.6. Miller (1940) found that dipping cheddar cheese in a solution of sodium or calcium propionate checked growth of mold, and that propionic acid had about double the effectiveness of either of the salts, probably because of the large concentration of undissociated acid. Miller also observed that sodium propionate was slightly more effective as an inhibitor of mold on cheese than was calcium propionate. A 14 percent solution of sodium propionate was as effective as 16 percent of the calcium salt.

Despite the very definite effect of propionate on microorganisms, its toxicity to man or animals appears to be low. Appreciable amounts of propionic acid or its salts occur naturally in cheese, particularly cheese of the Swiss type, which may contain as much as 1 percent propionate, largely calcium propionate. Although data on pharmacological aspects, such as changes in blood, organs or fertility, are not available, Harshbarger (1942) found that rats fed diets containing up to 3.0 percent of either calcium or sodium propionate showed no significant differences from control animals in weight gained. Macy (1942) also testified to the unobjectionable nature of the compounds when used as mold inhibitors in foodstuffs.

Effect on Microorganisms

Nutrient broth was used in studies *in vitro* at pH 4.5, 5, 6 and 7. For experiments at pH 3.5, yeast-extract glucose broth was used. The pH was adjusted after sodium propionate was added in amounts varying from 0.1 to 5.0 percent. Controls containing no porpionate were run in each series. The inoculum was 0.05 ml. of a rapidly growing broth culture, added to 5 ml. of broth in a culture tube. The inoculated tubes were incubated at 25 deg. C. (77 deg. F.) for 5 days. At the end of that time, the lowest propionate concentration that completely inhibited growth in each set was noted. The results are summarized in Table I.

Although growth of several of the test organisms was not stopped by a 5 percent sodium propionate solution at pH 7, the propionate did delay development of turbidity in the cultures under these conditions. Slight turbidity did not appear in the cultures until the following times had elapsed: *Staphylococcus aureus*, 3 days; *Sarcina lutea*, 5 days; *Proteus vulgaris*, 2 days; *Lactobacillus plantarum*, 3 days; *Torula*, sp., 2 days; *Saccharomyces ellipsoideus*, 5 days. The results indicate that the organisms, although able to grow under the conditions mentioned, were inhibited before they overcame the suppressive effect of the salt.

The effectiveness of sodium propionate in suppressing growth of the 12 microorganisms tested varied markedly with the pH of the substrate. The concentration of propionate required to inhibit growth decreased as the pH was lowered. For example, only one-fortieth as much propionate was needed to stop growth of *Escherichia coli* at pH 4.5 at at pH 7.0. As would be expected, the tubes next in order to those remaining negative showed delayed and scanty growth, as compared with the controls.

Treatment of Fruit

The first tests on fruit were conducted on freshly harvested Kadota figs. About 100 lb. of figs (pH approximately 5) was divided into three portions, which were treated respectively as follows: (1) dipped in 15 percent calcium propionate solution for 3 minutes and drained, (2) dipped in a similar solution and ground, and (3) ground to a puree in which 0.5 percent of propionate, by weight, was incorporated. Treated samples and controls were incubated at approximately 21.1 deg. C. (70 deg. F.). The results of bacteriological tests at the end of 30 and 50 hours, in which dextrose agar at pH 7.0 was used as the culture medium, are presented in Table II.

On the second day, mold development was well under way in the untreated fruit, which, within a few days, had settled to about half the original volume and was nearly covered with a brown, turbid liquid. Mold growth was luxuriant. At the end of a week the treated whole figs were still sound; no mold was visible and very little liquid had drained from the fruit, which was still edible.

The high bacterial count of the untreated ground figs after 30 hours can be attributed to the fact that grinding destroyed the natural protection afforded by the skin of the figs and at the same time inoculated the entire mass by mixing the microorganisms thoroughly with the comminuted fruit. In the treated fruit the calcium propionate adhering to the surface was mixed in the fruit along with

Precautions

Use of propionates to prevent rapid spoiling of fruits and vegetables appears a very promising possibility for many food processors. But if we undertake to apply the results of the Western Regional Laboratory, we should note carefully two precautions which the authors of this article themselves state clearly, as they say:

"The treatment should be used to maintain quality in sound material for a limited time; it will not improve inferior material. Propionate dipping of raw material to reduce deterioration due to microbial growth should in no way be objectionable, since commodities are later washed in the manufacturing process. On the other hand, incorporation of the salts in the finished product might be open to question, though they are now being used in bread and other bakery products."

In other words, we cannot substitute propionate treatment for proper selection of raw material. And, second, we must remember that the Food and Drug Administration does not accept processed foods which contain chemical preservatives of this sort without grave question as to the propriety of such practice.—THE EDITORS.

TABLE I—Concentration of Sodium Propionate Required in Broth Culture Media to Inhibit Microbial Growth at Various pH Values.

Microorganism cultured	Concentration of sodium propionate required to inhibit growth at pH				
	3.5	4.5	5.0	6.0	7.0
	Percent				
Escheichia coli	..	0.1	0.5	2.0	4.0
Staphylococcus aureus	..	0.2	1.0	2.0	5.0+[1]
Sarcina lutea	..	0.1	0.5	0.5	5.0+[1]
Pseudomonas fluorescena	..	0.2	0.2	0.2	1.0
Proteus vulgaris	..	0.1	0.5	2.0	5.0+[1]
Bacillus mesentericus	..	0.1	0.2	2.0	2.0
Lactobacillus plantarum	..	1.0	2.0	..	5.0
"Pink" torula	0.1	1.0	1.0	3.0	5.0+[1]
Saccharomyces cereviseae	1.0	3.0	4.0	4.0	5.0
Saccharomyces ellipsoideus	0.5	2.0	..	..	5.0+[1]
Aspergillus niger	0.1	..	0.5	2.0	5.0
Penicillium notatum	0.2	..	0.5	3.0	5.0+[1]

[1]Not inhibited by 5 percent sodium propionate at pH 7.

TABLE II—Effect of Calcium Propionate Treatment on Microbial Growth in Figs.

Treatment	Initial count per gram	Count per gram after 30 hours	Count per gram after 50 hours
None	132,000	46,000,000	612,000,000
Dipped 3 min. in 15% calcium propionate solution	1,800	1,490,000	17,500,000
Ground	33,200	3,130,000,000	.....
Dipped 3 min. 15% solution and ground	21,900	2,500,000	324,000,000
Ground and 0.5% calcium propionate added	14,500	550,000	3,200,000

TABLE III—Effect of Sodium Propionate Treatment in Controling Mold Growth on Berries.

Treatment	Youngberries				Blackberries			
	1 day	2 days	3 days	4 days	1 day	2 days	3 days	4 days
None	**	****	****	****	*	****	****	****
Dipped in 5% sodium propionate solution	0	*	**	***	0	*	***	****
Dipped in 10% sodium propionate solution	0	0	*	**	0	0	*	**
Sprayed with 10% propionate solution	0	0	*	**	0	0	*	***
Dipped in 10% propionate solution containing wetting agent (Calgon)	..	..	..	..	0	0	0	*
Sprayed with 10% propionate solution containing wetting agent	..	..	..	..	0	0	*	*

*One berry in box showing mold.
**Two to four berries in box showing mold.
***Not over one-fourth of berries in box showing mold.
****Most of berries in box showing mold.

TABLE IV—Effect of Propionate Treatment on Bacterial Counts of Peas Held for Varying Periods After Treatment

(Data, plate counts per gram, obtained after 1 month of frozen storage.)

Experiment I. Effect of sodium propionate treatment on bacteria in peas held at 80 to 90 deg. F. after treatment.

Time between treatment and freezing	Control, no treatment	Dipped 5 min. in 5% solution + 0.1% citric acid
None	181,000	121,000
Held 6 hours	217,000	67,000
Held 22 hours	1,225,000,000	88,000,000

Experiment II. Effect of sodium propionate treatment on bacteria in peas held at 80 to 90 deg. F. after treatment. The solution was allowed to stand at 80 to 90 deg. F. for 24 hours after a portion had been used in Experiment I.

Time between treatment and freezing	Control, no treatment	Dipped 5 min. in 5% solution + 0.1% citric acid
None	191,000	181,000
Held 8.5 hours	5,500,000	990,000
Held 22 hours	1,590,000,000	189,000,000

Experiment III. Effect of calcium propionate treatment on bacteria in peas held at 80 to 102 deg. F. after treatment.

Time between treatment and freezing	Control, no treatment	Dipped 5 min. in 5% solution + 0.1% citric acid
None	100,000	35,000
Held 22 hours	1,765,000,000	609,000,000

TABLE V—Effect of Sodium Propionate on Bacterial Counts of Lima Beans Held for Varying Periods After Treatment.

(Data, plate counts per gram, obtained after 2 to 6 weeks of frozen storage)

Experiment I. Effect of treatment with and without added citric acid on lima beans held at 56 to 90 deg. F.

Time between treatment and freezing	Control, no treatment	5-min. dip in 5% solution	5-min. dip in 5% solution + 0.1% citric acid
None	4,500	4,300	10,500
Held 17 hours	520,000,000	100,000	55,000
Held 24 hours	.....	500,000	2,400,000
Subjective appraisal at 24 hours (not frozen)	Color faded, slimy, bad odor	Normal appearance and odor	Normal appearance and odor

Experiment II. Effect of short immersion in 10% solution on lima beans held at 60 to 92 deg. F.

Time between treatment and freezing	Control, no treatment	15-sec. dip in 10% solution	30-sec. dip in 10% solution
None	21,700	17,000	16,000
Held 24 hours	1,890,000,000	67,000,000	9,200,000
Subjective appraisal at 24 hours (not frozen)	Color brown, surfaces slimy, odor very unpleasant	Normal appearance and odor	Normal appearance and odor

Experiment III. Effect of addition of citric acid or wetting agent to solution for treatment of lima beans held at 60 to 100 deg. F.

Time between treatment and freezing	Control, no treatment	60-sec. dip, 5% solution	60-sec. dip, 5% solution + 0.2% Calgon	60-sec. dip, 5% solution + 0.1% citric acid
None	70,500	22,500	77,000	83,000
Held 24 hours	310,000,000	55,000,000	44,000,000	89,000,000
Subjective appraisal at 24 hours (not frozen)	Color brown, surface slimy, odor very disagreeable	Normal appearance, stale odor	Normal appearance, stale odor	Normal appearance, stale odor

Experiment IV. Effect of temperature on lima beans treated in sodium propionate solution.

Time between treatment and freezing	58 to 77 deg. F.		60 to 105 deg. F.	
	Control, no treatment	60-sec. dip, 5% solution	Control, no treatment	60-sec. dip, 5% solution
None	131,000	122,000	131,000	122,000
Held 21 hours	115,000,000	5,600,000	820,000,000	175,000,000
Held 24 hours	1,860,000,000	9,800,000	3,700,000,000	200,000,000
Subjective appraisal at 24 hours (not frozen)	Faded color, slimy surface disagreeable odor	Normal appearance and odor	Color, odor, and appearance off	Color and odor off

the microorganisms that may have been present. Although the microorganisms were worked into the mass, the inhibiting agent was there and microbial growth was slowed down.

In experiments with youngberries, a sample of the fruit was treated in each of three ways: (1) dipped in 5 percent sodium propionate solution for 60 seconds, (2) dipped in 10 percent sodium propionate solution for 60 seconds, and (3) sprayed with sufficient 10 percent sodium propionate solution to wet the fruit thoroughly. The accompanying photograph shows the fruit on the fourth day after treatment. Although the treated berries showed mold growth, the samples treated with 10 percent sodium propionate solution required 4 days to reach the degree of moldiness attained by the control in 24 hours.

Blackberries were treated in the manner described above for youngberries. In addition, a fourth treatment, consisting of dipping for 60 seconds in 10 percent sodium propionate solution containing 0.1 percent of sodium hexametaphosphate as a wetting agent, and a fifth

(*Turn to page* 176)

—PSYCHOMETRICS—
New Quality Control Tool?*

The use of persons as analytical research tools is proposed here. The purpose is to determine the nature of biochemical reactions underlying changes in dehydrated foods during processing and storage. The technic has wide possibilities

By CAPT. GEORGE GELMAN
Quartermaster Subsistence Research and Development Laboratories, Chicago, Ill.

CONSIDERABLE discussion and debate has arisen concerning not only the propriety of the term "psychometrics" but the objectives it attempts to accomplish, the technic required for accomplishing these objectives (from the standpoint of panel selection, treatment of product and effect of environmental factors), and the distinction or differentiation of psychometrics from a host of other activities that involve the use of human subjects.

The term "psychometrics" was first brought to the writer's attention by Dr. E. H. Scofield of the Joseph E. Seagram & Sons, Inc. Laboratories. The Seagram laboratories have reported at a recent American Chemical Society convention in New York City on their use of psychometrics as a quality control tool. The procedures have been applied by only a few other laboratories on only a limited number of products.

Webster defines psychometrics as signifying "mental measurement." The level of abstraction connoted by this definition is too high to be meaningful as the term is used in food investigations. Because of the relative infancy of the general field of food acceptance research, it is to be expected that new nomenclature will require many appearances in the various technical publications over a prolonged period of time before clarity and comprehension will be established.

Only by constant usage with numerous illustrations will the term "psychometrics" convey a more definite picture. The justification for the selection of the term, if there be any, lies in both its weakness and its strength. It is weak because it is indefinite; strong because it does convey an idea of mental measurement sufficiently broad in its scope to encompass innovations that a more restricted definition might exclude.

CAPT. GEORGE GELMAN

Therefore, for purposes of indicating the nature of the term, and by no means to be construed as a definition or a crystallized understanding, it is suggested that the term "psychometrics" be used in food investigation to measure small sensory differences—small differences in the taste, odor, color, feel, consistency, particle size, and the like, of food materials. Any impression, judgment or indication of likes, dislikes or preferences is specifically excluded.

For a detailed illustration of the application of psychometrics in ascertaining the nature of biochemical reactions underlying deteriorative changes that occur in dehydrated foods during process, the reader is referred to the investigations on dehydrated eggs by Dr. Howard D. Lightbody, Western Regional Research Laboratory, U. S. Department of Agriculture, Albany, Calif., reported at the Army Conference on Dehydration held in Chicago on February 3.

Dr. B. B. Bohren, of the Poultry Husbandry Department, Purdue University, in a private communication, has indicated the successful application of a psychometric panel to powdered-egg studies. In this case, the so-called "extinction technic" is utilized.

The sample under investigation is diluted with a control to a point where there is no noticeable difference between the control and the diluted sample. The smaller the concentration of the sample required for dilution with the control to reach the extinction point, the greater the deteriorative change that has occurred in the sample.

Psychometrics, in addition to the applications previously discussed here, has been of value in the following types of activities:

1. Formulation
2. Blending
3. Process development
4. Engineering development
5. Quality control
6. Packaging

A psychometric panel requires the use of one or more individuals —usually not more than 10—who have demonstrated their ability to make sensitive, valid and reproducible discriminations on particular food products. The establishment of a psychometric panel is at best a time-consuming operation that requires the calibration of usually from 50 to 100 persons before a panel can be finally selected.

Attention is invited to the an-

(*Turn to page* 170)

*Presented before the Army Conference on Dehydration at Sherman Hotel, Chicago, Ill., Feb. 3, 1945.

Modern Technics Produce QUALITY CITRUS PRODUCTS

There is information for practically every technical and operating man in the food industries in this step-by-step account of citrus products processing. Not only are a dozen unit operations discussed but quality control procedures are outlined

By J. L. HEID, Chief Chemist, Florida Citrus Canners Cooperative, Lake Wales, Fla.

THERE are facilities for completely utilizing 200 tons of oranges and grapefruit daily in canned and concentrated juices, as well as for the disposal of by-products as cattle feed and citrus sirup, in the modernized plant of Florida Citrus Canners Cooperative. The output of this big plant, an important factor in stabilizing the marketing of the Florida citrus crop, is put at four to five million boxes of fruit a season.

Fruit is delivered to the processing plant by the 11 associations which own it and by others which share in the program. Trucks carry from 5 to 15 tons and, after weighing, are unloaded by backing into unloading ramps, opening the tail gates and allowing the fruit to flow onto chain and paddle conveyors which elevate it to grading tables at the top of the storage bins. Two tons of fruit can be handled per minute on these conveyors. At the same time, the fruit is inspected and defective fruits, such as splits, molds and rots, are removed before the fruit goes into the bin. Only sound, ripe fruit is used, the quality being checked not only by the inspectors of the association but by the state department of agriculture.

Bin capacity is 14,000 90-lb. boxes of oranges and 21,000 85-lb. boxes of grapefruit, almost a day's supply. The bins are supplied with spiral ramps or baffles which cushion the fall of the fruit and also provide adequate ventilation of the fruit.

From the sloping bin bottoms, the fruit is discharged onto belt conveyors which carry it to soaking tanks. Here it is immersed in strong soap solution for 30 seconds to loosen dirt and scale. About half the fruit received has come from packing houses where it has previously been washed. The other half comes direct from the groves and has had no previous cleaning treatment. All the fruit, however, is given a uniform washing.

Upon leaving the soaking tank, the fruit is carried through two washers, where it is cleaned by rotary brushes about 4 in. in diameter, at the same time being sprayed heavily with water. This is the first point in the process where considerable quantities of water are used. The total amount of water required for cooling, cleaning and condensing in this plant amounts to 2,500 gal. per minute and is supplied from four wells on the property.

The fruit is next conveyed into the extracting room. This room has ceramic tile floors and tile and glass block walls. It is also provided with a forced-air ventilating system so operated as to exclude insects. Outside air is drawn in through Precipitron electrostatic cleaners, then distributed throughout the area by means of ducts and diffusers. In this way, a slight plenum is maintained in the processing rooms so that an ample flow of air is maintained through openings which admit fruit, cans, and so forth, and through doors which must be opened from time to time. On the way to the extractors, the fruit passes a final inspection where any pieces which have been damaged during handling are removed. It then goes to machines which separate it into seven different sizes.

The automatic juice extractors are constructed of stainless steel and acid-resistant aluminum. The juice from the extractors is handled throughout the process in stainless steel pipes, troughs, tanks, pumps and filler bowls. Only stainless steel and (at a few points) nickel are permitted to come in contact with the juice. Contact with lead, zinc, copper and copper alloys is particularly guarded against, which, together with rapid handling methods, accounts for the fact that tests by government chemists reveal overall losses of vitamin C of less than 1 percent in all processes throughout the plant.

From the extractors, the juice passes through finishers, where it is separated from seed and pulp and pumped to six 500-gal. mixing and blending tanks. The seed and pulp go to the feed mill. While in the tanks, the juice is tested by a trained operator. If sweetened juice is being packed, sufficient sugar is added to raise the soluble solids content to a minimum of 13.5 deg. Brix. The tanks are equipped with agitators which aid in dissolving the sugar rapidly and in blending the juices for uniformity. Rapid mixing is necessary, as four filling lines can handle approximately 50 gal. of juice each per minute, allowing only about ten minutes for filling and emptying the tanks.

From the blending tanks the juice is pumped to the deaerators. It enters these through a high-velocity, small-tube heat exchanger in which the temperature is raised to about 150 deg. F. It then flashes into the vacuum chamber, which instantly cools the juice, removes all air and evaporates a small percentage of the product.

The mixture of air and evaporated juice (with its peel oil content) is passed through a surface condenser. Noncondensibles are removed by ejectors which maintain the vacuum, and the condensed material is passed through a centrifuge to separate the oil for

marketing separately as a steamed-distilled oil. The flavor-bearing juice is returned to the balance of the juice as it leaves the deaerator.

Automatic controls maintain liquid levels and temperature ranges constantly, shutting off the heat when the flow of juice is interrupted for any reason. It is fortunate that the least stable constituents of citrus peel oils are also the least soluble and the most volatile. This fact is of advantage in removing them by vacuum steam distillation during deaeration.

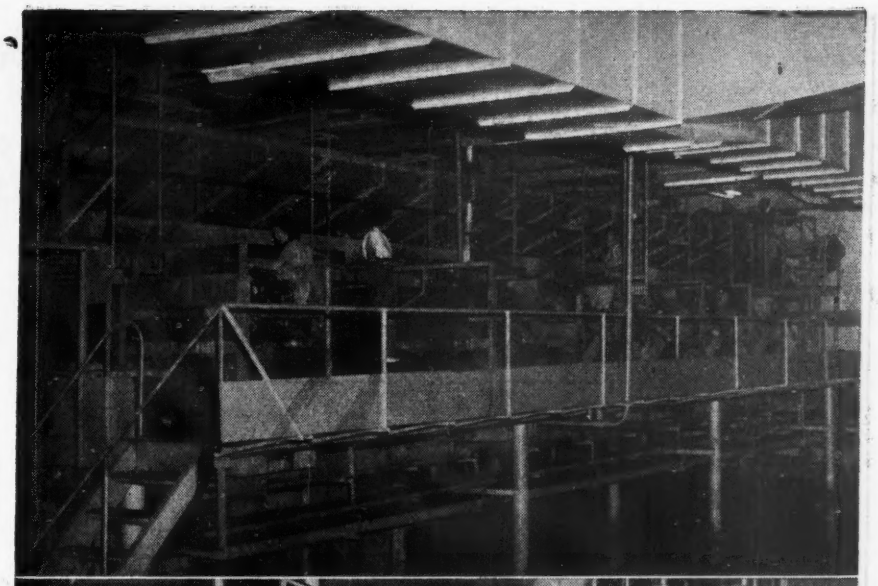
As a result, juice packed by this process has an extended storage life, particularly when stored under the high temperatures that may be encountered in the summer months.

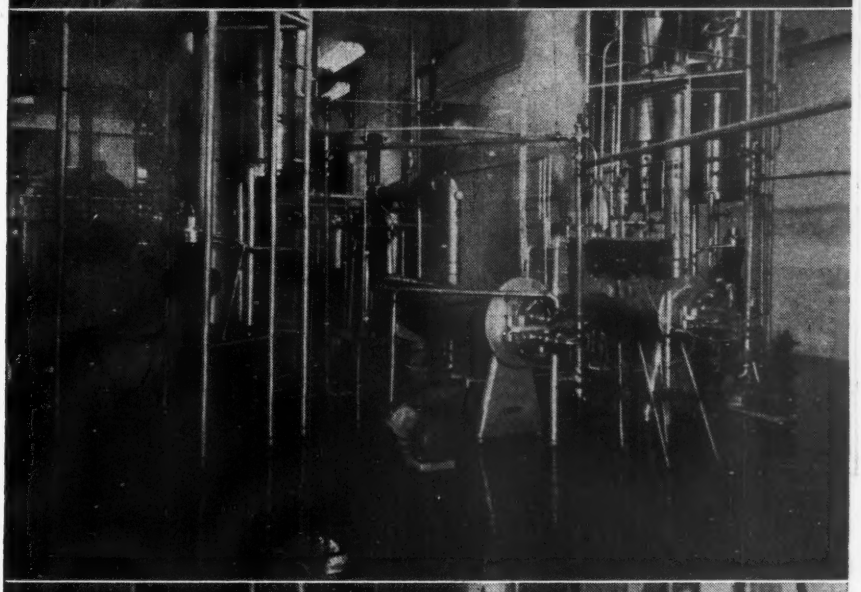
From the deaerators, the juice is pumped at high velocity through small-tube (1-in. diameter) pasteurizers, where it is heated rapidly and uniformly to 205 deg. F. to inactivate enzymes and destroy spoilage organisms. Only by using high velocity and rapid agitation is it possible to heat juice to this temperature without imparting an overheated flavor. Local heating must be avoided, and the juice must be rapidly cooled to below 100 deg. F.

The heated juice flows to the filler bowl where it is run into 250 18-oz. cans per minute, 160 46-oz. cans per minute or 50 100-oz. cans per minute. These cans are sealed, inverted and conveyed to an inclined belt provided with spray coolers. Here the cans are spun under spray water to cool them in less than two minutes.

Packing

The cooled cans are then passed into automatic machines, which apply the labels, place the cans in shipping cases and seal the cases. The juice packs include orange, grapefruit and a blend consisting of equal parts of the two. All this is packed either sweetened or unsweetened. The principal brand coming from this plant is "Donald Duck." Others are "Sealed-Sweet" and "Priceless." A small quantity of juice is packed under customers' labels. A much larger amount des-

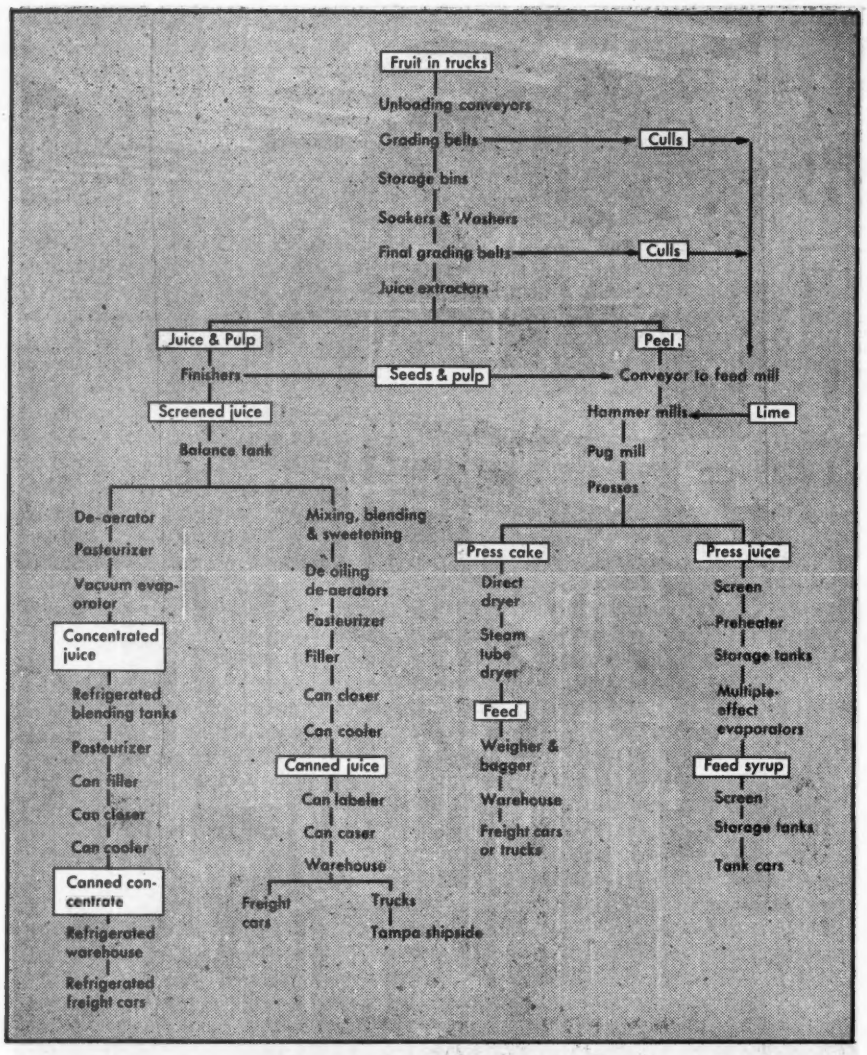




Battery of juice extractors located directly under sloping fruit sizers. Ducts maintain a positive pressure of clean air. (Top.)

Deoiling deaerators and pasteurizers, automatically controlled. (Center.)

Juice blending, testing and sweetening platform. Platform floor is of expanded metal for safety and sanitation. (Bottom.)



Flow diagram of citrus juice concentrating, canning and byproducts operations.

tined for military agencies is not labeled, but the cans are coated with dull, olive drab camouflage and protective paint applied by dipping and drying in automatic equipment. Packs destined for civilian markets are cased in corrugated cartons. Juice going to military agencies is cased in waterproof, solid fiber V-2 cases with sleeves and metal straps.

Cases are moved by conveyors, lift trucks and tractor-trailers into four warehouses, the newest and largest of which has a capacity of about 600,000 cases. All of these warehouses are insulated and ventilated to maintain storage temperatures as low as practicable without refrigeration. Rail shipments are loaded directly into the cars on adjacent siding. These connect with the two rail lines. Water shipments are trucked to Tampa.

Concentrated Juices

In the concentrating room, a double-effect, three-stage vacuum unit concentrates orange juice to 65 deg. Brix, as estimated from a corrected refractometer reading. Equipment in this installation includes an efficient deaerator, a flash preheater (to inactivate enzymes and destroy spoilage organisms) and the double-effect evaporator, the first effect operating at 20-in. vacuum and the second at 28.5-in. vacuum. Juice flows through the two stages continuously at an entry rate of about 3,000 gal. per hour, and the Brix is raised to about 50 deg., at which point the viscosity increases sufficiently to interfere with rapid heat transfer.

To secure high capacity, minimum retention time, and continuous operation, the partially concentrated juice is transferred to a small finishing pan where the Brix is rapidly raised to 65 deg. and the material is pumped out continuously by a positive-action metering pump into refrigerated and insulated blending tanks. In these tanks, it is heated to 160 deg. F. in high-velocity tubular heat exchangers before filling in full-gallon (No. 12) tin cans which are sealed under vapor to exclude oxygen. The cans are inverted for three minutes, then cooled as rapidly as possible to 40 deg. F., at which temperature the concentrate is cased and stored under refrigeration. Labels are lithographed upon the can ends.

The concentrate is a heavy, viscous, golden sirup. Special precautions are necessary for reconstituting it to single-strength juice. Because of the necessity of using cold storage, the importance of training for proper use and the precautions already mentioned, distribution has been limited to large users. More than 95 percent of the pack has gone to government purchasing agencies. In ordinary times it may reasonably be anticipated that carbonators and other beverage-base manufacturers will find the full fruity character of this product interesting.

Laboratory

Juice canning and concentration operations are conducted under government continuous inspection. Cleaning and processing operations are checked continuously, and samples of the finished product are taken at frequent intervals for grading and analysis. Finished products are subject to grading as *A*, *C* or "sub-standard."

Other responsibilities of the laboratory include advising the production and sales departments upon technical matters, trouble shooting throughout the plants, training and checking plant test-station operators, checking controls, and research and development work.

Other Products

Every fruit which enters the plant is completely utilized. Peel and pulp from juice extracting operations is conveyed to hammer mills where it is ground with less than 1 percent of added lime. After aging in bins, the ground stock is pressed upon roll and screen presses to separate juice from the press cake.

This press cake is dried first in a direct-heated rotary kiln and finally in steam-tube dryers to a moisture content below 8 percent. It is valued by beef and dairy cattle feeders as a conditioner. When fed up to one-fourth of the total ration, it has beneficial effects upon the condition of the coat, thickness of flesh and yield of milk.

Juice from the presses is concentrated in multiple-effect vacuum

evaporators, including a finishing stage, to a solids content of 72 percent. It resembles black-strap molasses in appearance and sugar content, and is valued by feeders for the supplemental food values extracted from the peel. There is some demand for the sirup as a source of fruit spirits for use in brandies, cordials and fortified wines.

Distribution

Processed citrus products are distributed through a nation-wide brokerage representation consisting of some 50 firms. These cover the United States and the principal cities of Canada, with an average of from three to four salesmen each.

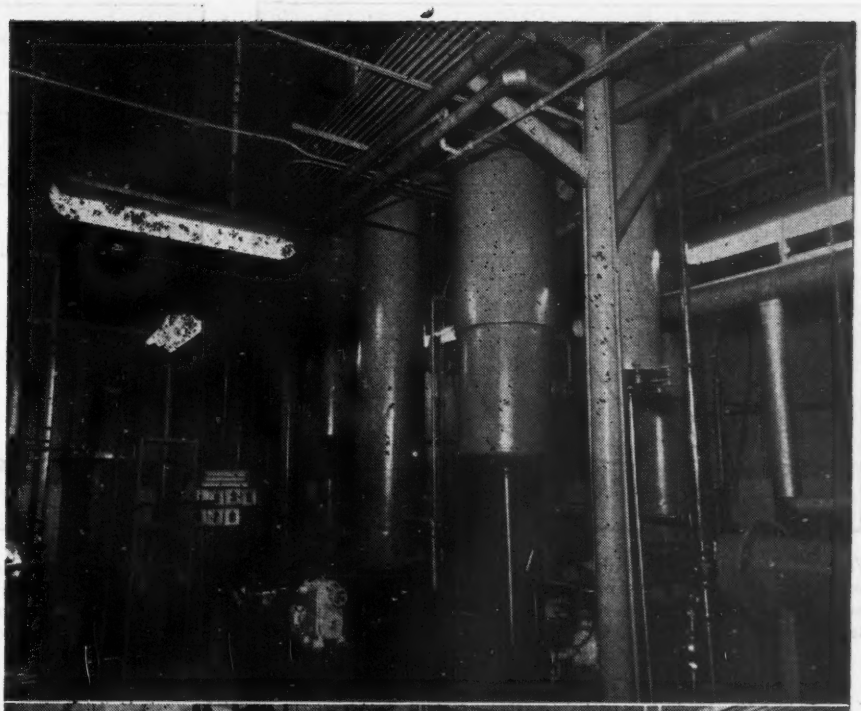
Distribution is considerably larger East of the Mississippi than in the Western states, probably due to concentration of population in this section. Up to the present time, governmental agencies have been the largest buyers of these products.

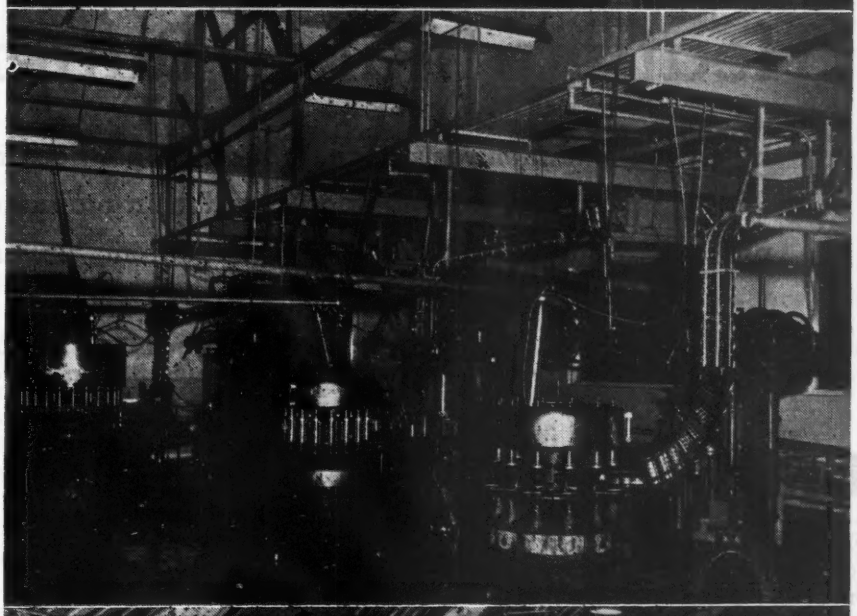
The Outlook

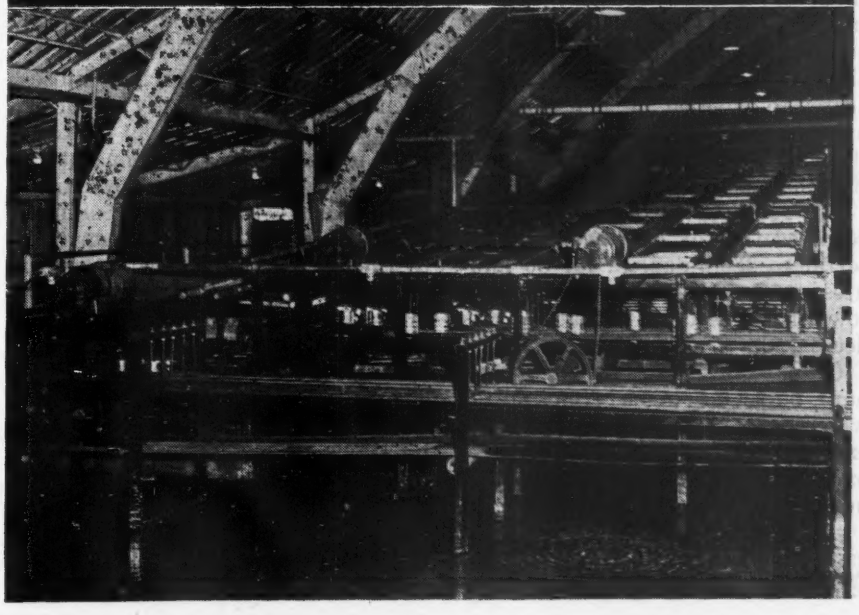
New facilities are now being added to the feed and sirup equipment. After the war, additional equipment and plant facilities will follow for specialty juice products, the packing of fruit hearts, and possibly other items. In commenting on prospects and plans, President Harold Norman said:

"The rate of increase in the consumption of canned citrus products has exceeded any other development in the canning industry. A steady expansion may be expected in the years following the war.

"While improperly planned and inadequately financed operations may not survive readjustment periods and the fluctuations of the market, progressive and well-organized plants will undoubtedly supply increasing quantities of improved, and new products. Canned, frozen and dehydrated citrus products will become important, palatable and staple sources of the vitamins and minerals which they contain. They will be found in the diet of the entire American family, in every income group."







Double-effect, high-velocity juice concentrator with capacity for concentrating 3,500 gal. of juice per hour to 500 gal. of 65 deg. Brix concentrate. (Top.)

Three filling lines showing can sterilizers, fillers and sealing machines. (Center.)

Ten-lane can cooler. All sizes of cans are conveyed and spun under sprays of cooling water while traveling up the inclined belts. (Bottom.)

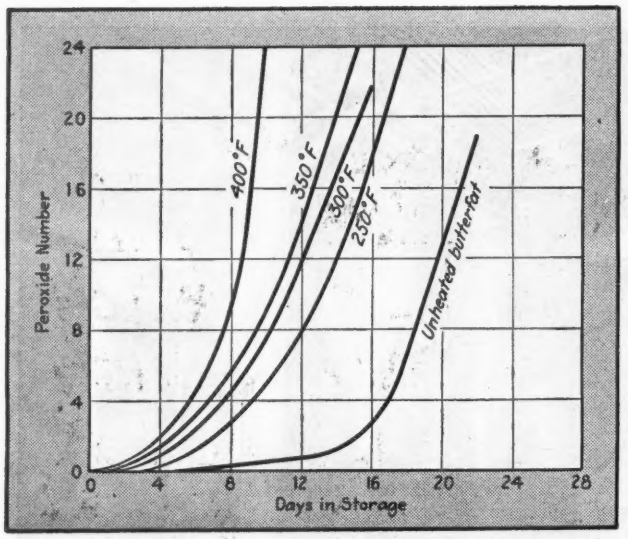


FIG. 1. Heating pure butterfat has a deleterious effect on the oxidation stability of the product during storage. Samples represented by these curves were heated for 10 minutes at each of the temperatures indicated and then held in storage at 140 deg. F.

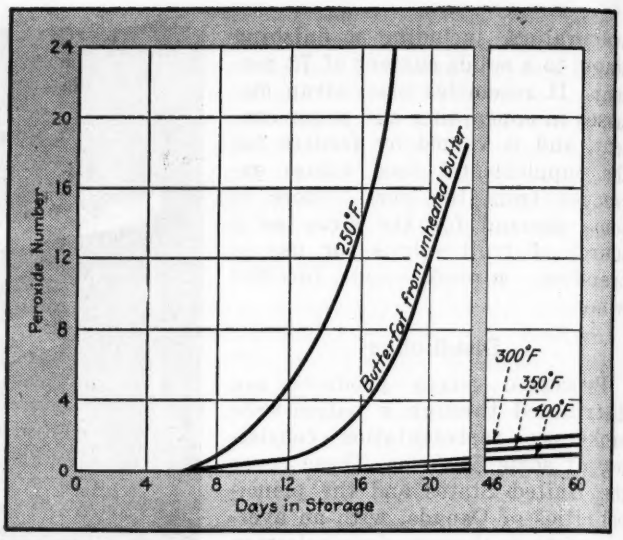


FIG. 2. Heating the butter before separation has a beneficial effect on the oxidative stability of the butterfat produced. Samples represented by these curves were heated for 10 minutes at each of the temperatures indicated and stored at 140 deg. F.

Heating Makes Butterfat Keep*

Increased oxidation resistance through proper heat-treatment may improve the keeping quality of butterfat included in manufactured dairy products, processed foods and candy, thus maintaining flavor over longer periods

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FOR at least the past hundred years it has been the practice among certain people of central Europe to boil or cook butter prior to storage.[1,2] This practice apparently is similar to that followed in India for the preparation of the native ghee.[3] The "eingesotten" (boiled) butter of Switzerland is heated to drive off the moisture and bring about changes which render the butterfat resistant to oxidative changes.

But recently, Ewbank and Gould[4] reported that by heating pure butterfat to 260.6 deg. F. for 30 minutes the stability of the product toward subsequent oxidation was decreased.

Other workers[5,6] reported that pure butterfat taken from butter which had been previously heated exhibited greater resistance to oxidation than that from butter heated to lower temperatures.

The experimental work reported here indicates that there is an improvement in keeping quality through the processes developed over the years. We can now show that when pure butterfat is heated to temperatures ranging from 250 to 400 deg. F. for 10 minutes its oxidative stability during subsequent storage is greatly reduced. But when butter, without separation, is heated in the temperature range between 300 and 400 deg. F. for the same time, a very significant stabilizing effect is imparted to the butterfat obtained from it.

Addition of a small quantity of dry skim milk to butterfat from unheated butter, with subsequent heating to 400 deg. F., also causes a relatively high degree of oxidative stability in the product. Combinations of lactose and milk protein, with or without milk phospholipids, are quite effective antioxidants in the heated butterfat. Milk phospholipids alone are not.

The mechanisms of the stabilizing effect resulting from heat treatment of butter or of butterfat in the presence of milk-solids-not-fat is not clearly understood. For the whole butter it appears to be a reaction involving the protein-phospholipid complex in the curd fraction. In the case of the dry skim milk there is evidence of a reaction involving the lactose and the milk proteins.

Butterfat heated with dry skim milk undergoes the processing without material change in flavor, odor, or color of the filtered fat. That obtained after heating butter usually possesses a tan or brown color, as well as a characteristic cooked odor.

The results are significant, because it is probable that procedures found effective in preventing oxidative changes in heated butterfat may have extensive application in improving the quality retention of manufactured food products which incorporate butter and similar fats.

*Authorized for publication on March 29, 1945, as paper No. 1276 in the Journal Series of the Pennsylvania Agricultural Experiment Station.

For these investigations, butterfats were obtained from fresh cream pasteurized at 150 deg. F. (66 deg. C.) for 30 minutes. The cooled cream was churned and the butter granules washed with cold water. The finished (unsalted) butter was stored for 24 hours in a refrigerator prior to further treatment. Pure dry butterfat was obtained by heating the butter to 140 deg. F. (60 deg. C.) and separating the supernatant melted fat in an International laboratory centrifuge.

When this clear butterfat was filtered through Whatman No. 2 filter paper with the aid of a hot-water-jacketed funnel heater, the product was practically moisture-free and repeated analyses showed it to be essentially void of phospholipid materials.

Test Method

A very simple apparatus was employed for heat treating the samples. A 500-ml. Pyrex wide-mouth Erlenmeyer flask containing about 400 ml. of mineral oil served as a heating bath, with a precision electric heater. Fifty grams of butterfat, with or without added materials, or the equivalent amount of butter, was put in each 100-ml. Pyrex tube, and these tubes were placed in the hot-oil bath. Following heat treatment, the samples were filtered directly into storage tubes which, fitted with bakelite screw caps, were stored in the dark in an incubator set at 140 deg. F.

The peroxide number (millimoles of peroxide per kilogram of fat) was used as the index of oxidative stability, although evidence of oxidation was also observed by odor and by bleaching of the yellow color.

In a complex system such as butterfat the trend of the peroxide number is frequently somewhat erratic in the earlier stages and values may drop periodically during the incubation period.

The presence of natural antioxidants probably plays a part in this intricate mechanism. In a fat which is less resistant to oxidation, the rate of peroxide formation appears to be rather uniform during the relatively short induction period. At the end of the so-called induction period, all fats exhibit highly accelerated rates of peroxide formation.

Unlike most fats and oils, rendered fresh pure butterfat exhibits no normal peroxide content when subjected to the conventional peroxide test.

Heated Butterfat Oxidizes

Heating pure butterfat to high temperatures apparently destroys a large part of the natural antioxidants contained in the fat, as the data presented in Fig. 1 demonstrate very definitely. The control sample of unheated butterfat in this particular experiment resisted significant peroxide formation for 12 days at 140 deg. F., while butterfat which had been heated to temperatures ranging from 250 to 400 deg. F. for 10 minutes, prior to storage, exhibited similar peroxide values after three to five days. It will be noted that as the temperature of heating increased, the subsequent oxidative resistance of the butterfat decreased.

In all of the studies involving the heating of pure butterfat to high temperatures, it was observed that the yellow color of the butterfat, attributed to the presence of carotene, was noticeably more bleached as the temperature of heat treatment was increased. The flavor of the heated pure butterfat was bland and little affected by heat treatment.

Heating the Butter

The results obtained by evaporating the moisture from butter in beakers with low heat, and then heating the butterfat-curd mixtures to temperatures ranging from 250 to 400 deg. F. prior to recovering the butterfat by filtering, presented an almost opposite picture, compared to heating the pure butterfat. The data presented in Fig. 2 show that heating the butter to 250 deg. F. for 10 minutes had a deleterious effect upon the subsequent oxidative stability of butterfat recovered after heating, but heating to 300, 350 and 400 deg. F. for the same period imparted a high degree of stability. Repeated trials showed that the butterfats from butter heated to 400 deg. F. were most outstanding in this respect over longer periods of storage. In two instances there was no evidence of peroxide formation until after storage at 140 deg. F. for 120 and 180 days, respectively. What is most remarkable is that the antioxygenic effect must be attributed to the small amount of curd or residue (0.6 to 1.0 percent) which is present in the butter.

The residual curd material became browned at the lower treatment temperatures and visibly charred during heat treatment at 400 deg. F. The composition of this curd fraction is known to be largely phospholipids, protein (fat-globule membrane protein and casein) and small amounts of lactose and minerals. Since the browned or charred residual curd is removed by filtering after the butter is heated, its stabilizing reaction must take place during the heat treatment.

Whereas heat treatment of pure butterfat had a bleaching effect, heating the butter had a much different result. After heating the butter at 250 deg. F. there was little, if any, change in the color of the butterfat. However, butterfat recovered from butter which had been heated to the higher temperatures usually exhibited increasingly darkened colors ranging from tan to brown as the temperature increased. The odor of the more drastically heated samples was also different after heating. A characteristic cooked (not scorched) odor was usually in evidence in samples which had been heated to 350 to 400 deg. F. The initial degree of color and odor change appeared to

TABLE I—Effect of Milk Powder Constituents on Oxidative Stability of Heated Butterfat.

In each case, except for the control sample, heating was at 400 deg. F. for 10 minutes. Peroxide number after incubation at 140 deg. F.

No.	Butterfat with additions as indicated:	Days in storage: 1	5	10	13	20	23	33	43	55*	90
1	Control, unheated	0	0	0	0	3.2	3.4	6.7	26.0	...	...
2	Control, heated	1.4	10.4	19.7	24.0	...	...	...	...	...	...
3	Casein, 1 percent	0	0.5	1.4	3.0	5.6	9.4	20.6	...	...	...
4	Lactose, 1 percent	0.5	3.6	8.7	11.3	28.3	...	...	...	...	...
5	Albumin, 1 percent	0	0.6	1.6	3.3	6.2	...	...	...	...	...
6	Membrane protein, 0.5 percent	1.3	4.8	12.2	12.5	21.2	10.3	22.1	...	...	...
7	Milk phospholipids, 0.05 percent	0.6	2.9	8.3	9.4	14.5	15.7	22.6	...	...	...
8	Albumin and lactose, 0.5 percent each	0	0.3	0.4	0.6	3.6	3.9	3.8	4.3	4.5	...
9	Milk phospholipids, 0.05 percent and membrane protein, 0.5 percent	0	1.8	5.9	6.6	16.0	19.4	...	...	...	...
10	Milk phospholipids, 0.05 percent and lactose, 0.5 percent	0	0.3	1.2	2.8	7.0	10.9	27.2	...	...	...
11	Same as No. 10 plus casein, 0.2 percent	0	0.6	1.0	1.5	3.1	3.9	4.5	4.9	5.7	...
12	Same as No. 11 plus albumin, 0.2 percent	0	0	0	0.5	2.0	2.1	2.1	2.4	2.7	...
13	Dry skim milk, 1 percent	0	0	0	0.6	1.8	3.0	3.0	3.2	4.0	...
14	Butterfat from heat-treated butter	0	0	0	0.6	1.1	1.0	1.3	1.4	1.1	2.1

*Insufficient samples to carry over 55 days except in the case of sample 14.

vary somewhat between corresponding samples in different trials. The darkened color and cooked odor became less evident as the storage period progressed.

Effect of Curd

In order to study further the role of the curd fraction, a quantity of this material was isolated from the plasma which separated from the butterfat during centrifuging. It was dried under vacuum at low temperature and added back to the pure butterfat at the rate of 0.5 percent. Another part of the dried curd was extracted with ether to remove all traces of phospholipid and 0.5 percent of the dried ether-extracted product added to a sample of the pure butterfat. The results presented in Fig. 3 show that the curd fractions protect the butterfat to some degree during heating to 400 deg. F. but do not impart an antioxygenic effect which even approaches that exhibited by the unheated pure butterfat. On the other hand, heating butter containing curd in its normal state yielded a filtered butterfat which held up well for 90 days at 140 deg. F. Similar data were obtained in repeated trials.

It is apparent that the removal of the curd, as such, from the butter alters its normal physical-chemical relationship with the butterfat and that upon adding it back in the dried form the normal system is not reestablished. It should not be overlooked that during the isolation of the curd from the water-curd fraction, certain minor water soluble constituents (such as lactose and minerals) are eliminated from the insoluble curd. When ordinary butter was heated according to the standard procedure of these experiments the water soluble constituents were a part of the heated mixture and may or may not have played a part in the stabilization of the butterfat against oxidation.

The removal of the phospholipids from the dried curd residue did not have any apparent effect upon the antioxygenic effect of the material.

Dry Skim Milk Is Effective

A number of experiments were conducted in which dry skim milk or its constituents were used as antioxidants in the heat-treatment procedure. Preliminary trials indicated that these substances were relatively ineffective without heat treatment.

The effect of 1 percent of commercial dry skim milk when heated with butterfat is amply shown in Fig. 4. Again, the heating of pure butterfat alone was destructive to its subsequent oxidative stability. Heating in the presence of the dry skim milk imparted marked protective action at all temperatures. Even heating to 250 deg. F. gave significant protection in this experiment and in confirmatory trials, although this temperature had a destabilizing effect on the butterfat in butter (Fig. 2). Temperatures of 350 to 400 deg. F. imparted a relatively high degree of stability.

Unlike the butterfat from heated butter, the butterfats in the series containing dry skim milk exhibited practically no change in color or odor even after heating to 400 deg. F. for 10 minutes.

It is of interest that a patent issued to Musher[7] shows that the addition of 0.5 percent of skim milk powder to cottonseed oil prior to heating to temperatures in excess of 250 deg. F. imparts a strong antioxygenic reaction and an improved keeping quality to that oil.

Other Milk Constituents

In subsequent experiments employing various constituents of milk and combinations of these constituents prior to heat treatment, 400 deg. F. for 10 minutes was used exclusively, since previous experience had demonstrated the greater effectiveness of this temperature.

The results of one rather complete experiment are recorded in Table I. The unheated butterfat control used in this experiment was the most resistant to oxidation of any encountered in these investigations. The same butterfat heated to 400 deg. F. oxidized very rapidly.

Additions of 1 percent each of commercially produced lactose, casein, or egg albumin offered some protection to the heated butterfat, but none of these imparted as much oxidation resistance as that exhibited by the normal unheated fat.

In the quantities used, 0.05 percent for milk phospholipids and 0.5 percent for the other constituents, the phospholipids and fat globule membrane failed to give significant protection. Combinations of phospholipids with either lactose or fat globule membrane protein were relatively ineffective. On the other hand, lactose plus the egg albumin proved quite effective.

When casein and phospholipids were added to this combination (with the casein and albumin reduced to 0.2 percent each) the stabilizing effect was the highest of any of the combinations of basic milk constituents tried. In fact, the results with this particular combination compared favorably to those obtained with 1 percent of dry skim milk.

No combination of materials or heat treatment equaled the antioxygenic effect of heating butter alone to 400 deg. F. prior to recovering the butterfat. Consistently in these studies this technic was found to impart the highest degree of stability to the butterfat.

The fat globule membrane protein used was the residual material left after the extraction of the phospholipids and butterfat from the membrane concentrate. Phospholipids were isolated from the milk by a technic previously described by the authors[8] and analyses for the phospholipid content of the butter or butterfat were made by the method of Horrall.[9]

Other Antioxidants

Many other substances which have been shown to exhibit antioxygenic characteristics in fats and oils were tried in combination with heat treatments to ascertain their value in butterfat. Among these were ascorbic acid, molasses, oat flour, wheat germ, numerous aqueous and fat-solvent extracts of cereal flours and fat-free cocoa. Of these, 0.1 percent ascorbic acid, 1.0 percent molasses and 1.0 percent wheat germ produced antioxygenic effects with 400 deg. F. heat treatment which were superior to the normal antioxidant characteristics of unheated butterfat, but in no case did these materials equal the desirable effects resulting from the addition of dry skim milk or the procedure of heating butter.

Factors Responsible

The mechanism involved in the stabilization of butterfat from heated butter is not understood. Other workers have shown that the phospholipid fraction of milk, which is closely associated with the butterfat, is responsible for oxidized flavors in many dairy products.[10,11,12] But Ritter and Nuss-

TABLE II—Effect of Heat Treatment on Phospholipid Content of Butter.

Heat treatment deg F.	Phospholipids in fatty extract percent
None (control)	0.259
250	0.274*
300	0.259*
350	0.260*
400	0.250*

*Percent present in heated and filtered butterfat.

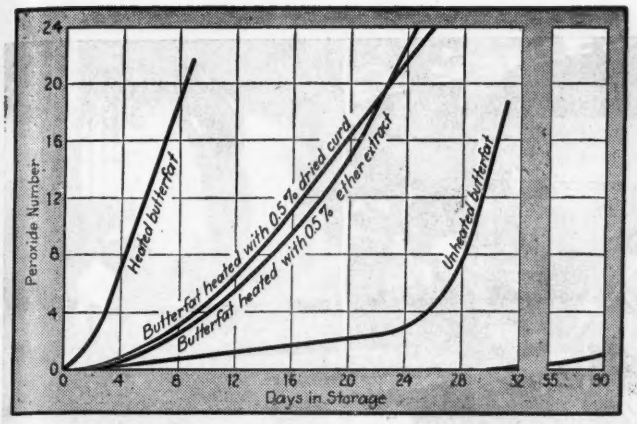

FIG. 3. Neither butter curd itself nor an ether-extracted curd, when added to butterfat before heating, improved the oxidation resistance. Samples, as noted, were heated at 400 deg. F. for 10 minutes and stored at 140 deg. F.

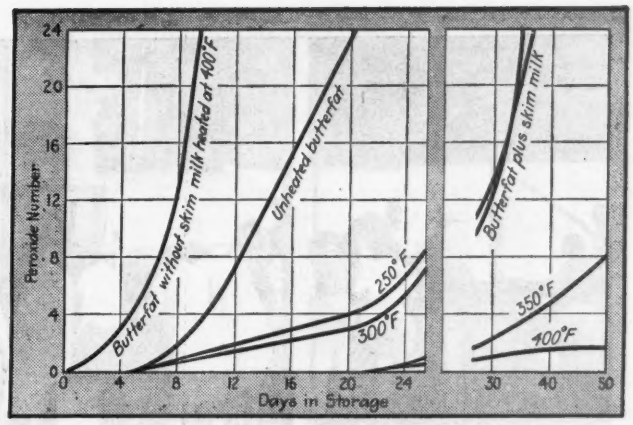

FIG. 4. Addition of 1 percent of dry skim milk before heating led to a more stable condition in heated butterfat. Samples were heated 10 minutes at each temperature and stored at 140 deg. F. Curves for skim milk at right.

baumer[6] and El-Rafey and his coworkers[5] feel that the protective action imparted to butterfat by the heating of butter to high temperatures may be attributed to an antioxygenic effect of the phospholipids normally contained in the butter.

El-Rafey's suggestion that transfer of the phospholipids to the butterfat phase from the nonoil phase of the butter during heating is largely responsible for the stabilizing effect, is given some support by the data in Table II. However, if the phospholipids, as such, were the sole contributing agents in the antioxygenic effect, butter heated to 250 deg. F. should keep as well as that heated to 400 deg. F. Since this was not the case in any of our experiments, and since additions of milk phospholipids alone and in combination with other milk constituents failed to produce comparable effects, other physical-chemical mechanisms must be involved in initiating the effect.

El-Rafey and his coworkers also suggest that reducing substances produced during the heating of butter to 230 and 266 deg. F. may contribute to the protective action on the butterfat. From the data available as a result of our own tests, it is not possible to explain the reactions which take place between 300 and 400 deg. F., but it may well be that at these temperatures some sort of reducing mechanism may be set up which is largely responsible for the antioxygenic effect.

From the data obtained with dried curd, milk phospholipids and combinations with milk phospholipids, it would appear that the mechanism in butter involves some very intricate reactions involving the protein-phospholipid complex and possibly other minor constituents in the non-fat phase. Since all of these substances, with the exception of the phospholipids, are removed from the fat during filtering, these reactions apparently take place during the heating process. It is possible that in the charring or decomposition of the nonfatty constituents during heating, certain molecular combinations or rearrangements with the phospholipids or butterfat might take place which carry over into the resultant filtered butterfat and contribute to its stability.

The reactions involved in the protective effect of dry skim milk and combinations of lactose and protein are also not known. The evidence, however, points to a lactose-protein reaction which in some way imparts antioxygenic characteristics (possibly of a reducing nature) to the butterfat.

Commercial Possibilities

The practicability of heat treating butterfats, either in the form of butter or pure butterfat with added antioxidant materials, has yet to be determined. If butterfat, treated by one of these procedures, responds as favorably in processed foods as it has in accelerated tests, it may be useful in many manufactured dairy products, processed foods and candy products where oxidative deterioration of the butterfat or related materials greatly decreases the palatability of the products.

The characteristic cooked flavor or odor of the filtered butterfat obtained by heating butter to high temperatures might be considered undesirable in certain products. On the other hand, practical commercial procedures may be worked out whereby the temperature treatment could be controlled so as to impart maximum stability to the fat with a minimum of cooked flavor or odor. In handling large volumes of butterfat, it would be necessary to use temperatures under 350 deg. F. because of the greater time needed for reaching the maximum temperature and for cooling. A limited number of trials were made using a large oil bath capable of heating a flask containing 3 lb. of butter. These experiments definitely demonstrated this fact and suggest that in setting up a procedure for heat treating butterfat, the matter of time as well as temperature must be carefully considered.

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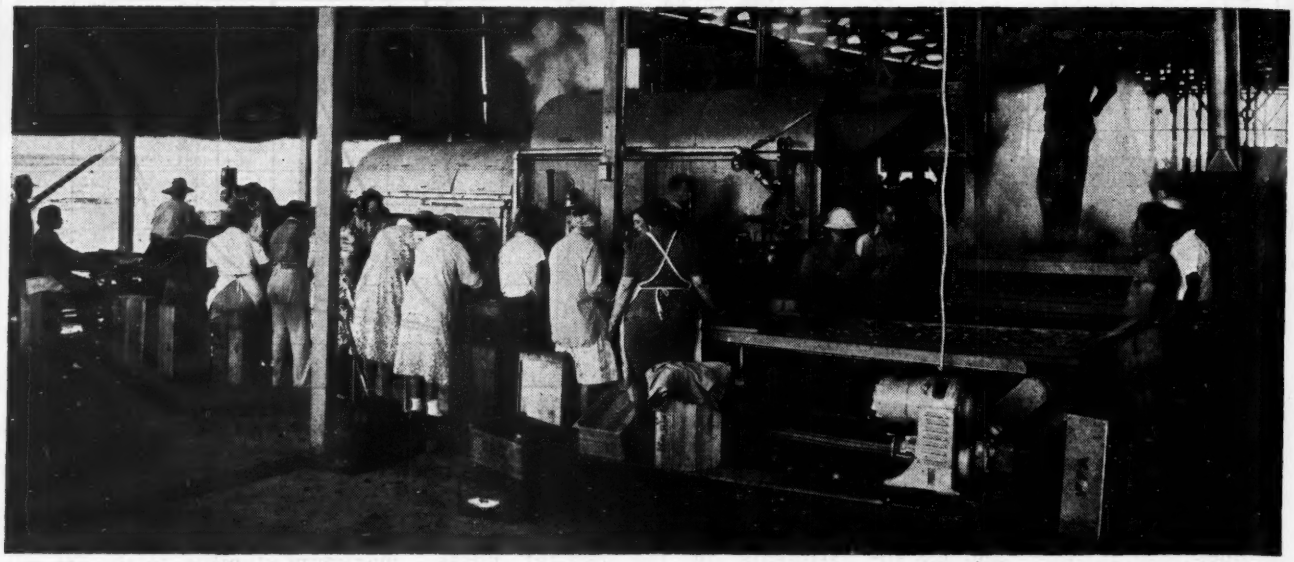

Courtesy Fresno Dehydrating Co.

Peach halves are fed into a lye peeler (upper center) and then go through a washer. The fruit is then trayed, sorted and conveyed to a continuous blancher (right).

New Methods Produce Superior Dehydrated Cut Fruits

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Part III—Clingstone Peaches and Pears—An entirely new product of good flavor and appearance is produced by blanching and dehydrating clingstone peaches. Dehydrated pears are better than the sun-dried product

PRESENT commercial practice is to dehydrate the peeled halves of clingstone peaches, after sulphuring, the process requiring from 22 to 30 hours, depending on the size of the halves. When dried, the fruit is opaque and of a straw-yellow color. To reconstitute it requires about 16 hours of soaking, followed by cooking until tender.

But both the drying time for clingstone peaches and the time necessary for reconstitution can be reduced greatly by blanching the halves in live steam before sulphuring. The blanched clingstone peaches reconstitute satisfactorily after 1 to 2 hours of soaking, and are superior in texture and flavor to the unblanched fruit. What's more, blanching gives the product a deep orange color and makes it translucent, giving an extremely appetizing and attractive dried fruit. Far from being an imitation of a sun-dried, or even dehydrated, fruit, it is an entirely new commercial product.

After preliminary laboratory and small-scale plant runs, about 600 dried tons of the new product were produced for government use in the 1944 season. The comments that follow are based upon field experience gained during the experimental run.

Grading and Harvesting

Some of the general principles of pretreatment such as size grading, peeling, blanching and sulphuring have been discussed before by Phaff, *et al* (1945*a*). To favor even steam penetration and uniform drying, clingstone peaches should be graded into at least two sizes; for instance, "large," 2½ in. and over in diameter, and "small," under 2½ in. This is particularly important if orchard-run fruit is used.

Because of the extreme susceptibility of clingstone peaches to bruising and the persistence of even slightly bruised areas as brownish spots in the dried product, the fruit should be handled carefully, and never shaken off the tree. Green fruit should be left on the tree because it has a very high shrinkage ratio and yields off-color dried fruit of shriveled appearance, even though the skin is removed in a lye peeler. Any of the canning cling varieties may be dried, but because of their better flavor and texture the Mid Summer varieties are preferable to the Tuscan and Levi.

Cutting and Pitting

Cutting and pitting can be done by hand. The flesh is cut around the suture and the pit removed by a spoon-shaped knife. However, it is much more economical to pit peaches with machines used by commercial canneries, freezing

plants and an occasional dehydrator (Cruess, 1938). The pits average 13.5 percent of the weight of the whole fruit.

In contrast to apricots and freestone peaches, the clingstone peach has a very firm flesh when fully ripe. So the cut fruit can be handled on conveyor belts and even loaded into lug boxes and stored for a short time.

Storage of the cut halves may be particularly important when labor is so scarce that not more than one and a half shifts of cutters can be organized. In this case it is often possible to accumulate enough fruit to keep plant operations going continuously. This is particularly desirable for the dehydrator. Since cut fruit spoils more rapidly than whole fruit, the storage time should not be extended unnecessarily. Browning may be reduced by dipping the cut halves into a 0.5 percent sodium bisulphite solution before storage. This is common commercial practice for sliced apples prior to drying.

Peeling

The peach halves are peeled by passing them through a hot lye solution. The temperature should be close to the boiling point, the lye concentration between 1 and 2½ percent, and the time of immersion from 30 to 60 seconds. In cases where the skin is difficult to remove, the lye strength may be increased and the time of application reduced. Heavy sprays of water remove the lye, and particular attention should be paid to the complete removal of lye from the pit cavity. A useful means for the detection of lye residue after peeling and washing is the application of a few drops of a 1 percent alcoholic solution of phenolphthalein on the suspected area. A bright red discoloration will show the presence of insufficiently removed lye.

After washing, the fruit is deposited on trays by a shaker and placed with cup side up by hand. At the same time, some trimming may be done and totally defective pieces sorted out. It is preferable that the trays move over a roller conveyor instead of one driven by a motor, because the speed of travel can be made slower or faster, depending on the influx of peeled fruit.

The fruit is then steam blanched on trays, in either a continuous-conveyor or cabinet blancher. In the former, the trays may be double decked to double the capacity. In the cabinet blancher, a manifold insures rapid steam distribution and reduces blanching time until it approaches that for a conveyor blancher. In the latter, an 11-minute blanch gave good results. A cabinet blancher holding two double cars of fruit, with only a steam inlet pipe lengthwise along the ceiling, required about 16 minutes for a complete cook.

While cutting the halves with a knife clearly shows the extent of heat penetration in apricots and freestone peaches, this method cannot be applied to clingstones because of the absence of a demarkation line. In underblanched fruit, however, a marked opaque yellowish area shows up in a deep orange background when the fruit is dried. Inspection of the finished product is at present the most reliable way to determine whether the blanching time is correct.

Sulphuring

Because of the firmness of the flesh, clingstone peaches do not have a tendency to bleed in the sulphuring house. For this reason, the fruit may be sulphured after blanching without being subjected to a preliminary drying period, as was advised for apricots and freestone peaches (Phaff, *et al*, 1945*b*). It is, however, very important to allow the fruit to cool to about 120 deg. F., or less, before sulphuring. If this is not done, sulphur dioxide absorption is very poor and the fruit is under-sulphured. When cars are taken out of a cabinet blancher, the rate of cooling can be greatly accelerated by placing the cars in an empty tunnel for a short time, e.g., 10 minutes, and turning on the fan, but not the heat. In this way, cars waiting to cool can be handled smoothly, and there is no bottleneck. If an empty tunnel is not available, the cars should be placed in a draft.

Clingstone peaches have good sulphur dioxide retention when dried under proper conditions. Absorption and corresponding retention figures obtained in a number of commercial plants are shown in Table I. Sulphuring time for the fruit described in Table I was 3 hours, and 7 lb. of sulphur was used per double car of fruit. The government specifications in 1944 called for a sulphur dioxide level in the finished product of between 2,500 and 4,000 p.p.m. Numerous tasting experiments have indicated that the sulphur dioxide flavor in clingstone peaches is more objectionable than that in apricots. For this reason it would seem that the upper level of 4,000 p.p.m. is somewhat too high and should be reduced if the fruit is stored in a temperate climate. A range of 2,000 to 3,400 p.p.m. is preferable when the fruit is not exposed to tropical storage conditions.

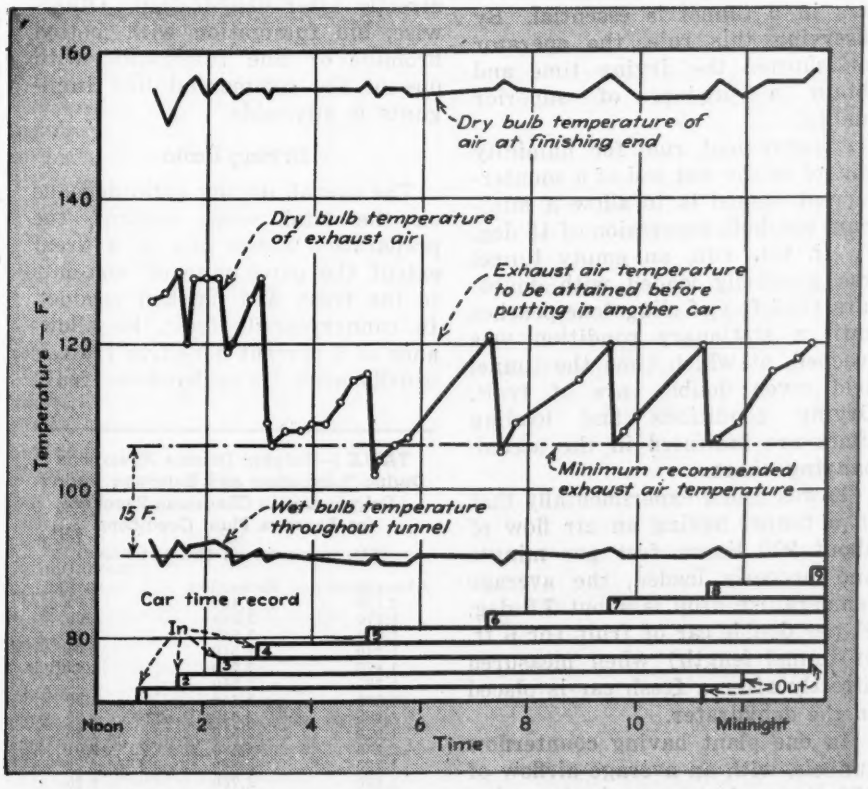

Diagram showing air temperatures, wet-bulb temperature and car-loading schedule in a counter-flow tunnel with an air flow of 950 linear feet per minute. Double cars were used.

Lowering the sulphur dioxide level means improvement in flavor but a small sacrifice in storage life as far as the occurrence of dark color is concerned. Preliminary tests by Stadtman (1944) and others indicate that clingstone peaches have about 30 percent longer storage life than Blenheim apricots when compared under identical conditions.

To obtain fruit with about 3,000 p.p.m. of SO_2, the recommended sulphuring procedure is to sulphur 3 hours with 6 lb. of sulphur per double car.

Dehydration

General rules for control of the humidity and loading of a series of tunnels were discussed in Part I of this series. Stadtman, *et al.* (1944) found that a finishing temperature of 160 deg. F. can safely be applied to clingstone peaches, provided the fruit is not dried to a moisture content lower than 25 percent. Blanched peeled clingstone peaches release their moisture quite rapidly because of their great evaporating surface. In a dehydrater with an average airflow (about 750 linear feet per minute) usually not more than 10 to 12 single cars can be present in the tunnel without raising the humidity excessively. It should again be emphasized that a proper time interval between introduction of successive cars in a tunnel is essential. By observing this rule, the operator can shorten the drying time and obtain a produce of superior quality.

A convenient rule for humidity control on the wet end of a countercurrent tunnel is to allow a minimum wet-bulb depression of 15 deg. F. In this run, an empty tunnel was gradually loaded with double cars (6x6 ft.) of clingstone peaches until a stationary condition was reached, at which time the tunnel held seven double cars of fruit. Drying conditions and loading times are indicated in the accompanying chart.

It was found experimentally that in a tunnel having an air flow of about 900 linear feet per minute and properly loaded, the average temperature drop is about 7.5 deg. F. per double car of fruit (or 6 ft. of tunnel length) when measured directly after a fresh car is placed in the dehydrater.

In one plant having counterflow tunnels, with an average airflow of 950 linear feet per minute and a finishing temperature of 155 deg. F., the average drying time was 12½ hours.

One objection to double cars, besides their weight, is the necessity of turning them on turntables when they reach the dry end of the tunnel. This must be done because the front and back end of a 6 ft. car dry rather unevenly.

When dried to a moisture content between 25 and 30 percent, peeled clingstone peaches show very little tendency to cling to the trays, and no special tray treatment is necessary to prevent sticking. The peeled fruit is very sensitive to the stain caused by rusting nails, so there should be no nail heads exposed on the tray surface where the fruit is placed. Trays stored during the winter should be completely cleaned of black mold as it tends to discolor the fruit.

Handling of the Fruit

When the dehydrated fruit has cooled, it should be scraped as soon as possible to avoid further drying, otherwise the fruit will be quite uneven in moisture content. Stored in a cool place, in clean boxes, stacked close together, the fruit can be kept for several days without much added drying. If the fruit is to be processed, however, there is no objection to its drying to about 18 or 19 percent moisture.

Fumigation is unnecessary if the fruit is handled quickly and packed directly after dehydration. Otherwise, bin fumigation with methyl bromide or line fumigation with one of the commercial line fumigants is advisable.

Drying Ratio

The overall drying ratio depends on the total solids content, the preparation losses and to a great extent the percentage of sort-outs in the fresh and finished product. In cannery-grade fruit, an allowance of 6 percent defective fruit is usually made. In orchard-run fruit, the percentage may be considerably higher. Although the drying ratio of the flesh itself ranges from 5 or 6 to 1, the overall drying ratio of No. 1 fruit frequently is slightly more than 9 to 1.

It is possible to test the solids content of the fresh fruit with a refractometer. In this way one can orient himself about the flesh drying ratio and determine whether too immature fruit is being delivered. There is a fairly constant ratio between soluble solids as determined by the refractometer and total solids as determined by a vacuum oven. The average numerical value of this ratio was found to be 1.086. In other words, if the soluble-solids content expressed as sucrose (found by means of the refractometer) is multiplied by 1.086, total solids content is obtained. The drying ratio equals S_2/S_1, in which S_2 is the solids content of the dried product and S_1 the solids content of the fresh product. Assuming that the product is to be dried to a moisture content of 25 percent, the universal value of S_2 is 75. After determining the value of S_1 as described above, the drying ratio can be calculated. The overall drying ratio equals $\frac{S_2}{S_1 \times a}$, in which a represents the fraction of the fruit recovered after preparation. For instance, if sorting, pitting and peeling removes 35 percent of the fruit, the recovery is 65 percent and $a = 0.65$. This value is a reasonable figure for good quality peaches, pitted and peeled according to good commercial practice.

Clingstone peaches constitute a fairly good source of ascorbic acid, and it was shown to be very stable during pretreatment and dehydration.

TABLE I—Sulphur Dioxide Absorption During Sulphuring and Retention During Dehydration in Clingstone Peaches for Average Plant Conditions.

(SO_2 in p.p.m. on the wet basis)

Absorption	Retention	Retention ratio
2,170	4,460	2.06
2,170	3,580	1.65
1,520	3,640	2.40
1,240	2,540	2.05
1,470	2,760	1.87
1,380	2,340	1.70
1,830	3,640	1.99
1,480	2,940	1.99
1,930	3,570	1.85
2,230	4,480	2.01
1,780	3,860	2.22
1,220	2,750	2.25
2,290	3,510	1.53
1,360	2,940	2.18

Average retention ratio 2.0

Drying Whole Cling Peaches

Several operators have produced cling peaches dried whole. In this case the fruit is lye peeled, washed, blanched, sulphured and dried. The great advantages are elimination of cutting cost, very low preparation losses (lye peeling removes only about 3.5 percent) and a very favorable drying ration (about 4 to 1). The dried product is very suitable for preparation of pickled peaches in the home.

In a cabinet blancher complete heat penetration requires about 18 minutes for a peach 2.5 in. in diameter, and 24 minutes when the diameter is 3.5 in. If the heat penetration is incomplete, the core

Courtesy El Solyo Ranch

Pitting clingstone peaches by machine. The cut halves are carried off in boxes.

section is frequently wet when the outside appears well dried. If this is the case, the moisture slowly diffuses from the center to the periphery, so that the fruit becomes sticky and wet on storage and may actually mold. Since the product is primarily intended for domestic consumption, the sulphur dioxide requirements are lower than if the fruit were intended for shipment to the tropics. Since the absorption of SO_2 is much lower in whole fruit, a sulphuring period of 3 to 4 hours with 7 lb. of sulphur per double car is sufficient.

Production Figures

Nearly all clingstone peaches produced in the United States are grown in California. This fruit, in contrast to the freestone variety, is used primarily for canning. Statistical figures by Shear (1943) show that of the 300,000 to 400,000 ton yearly crop, only about 5 to 10 percent is dried at present. Prior to 1931, only insignificant quantities of clingstone peaches were dried commercially.

Sun drying was found to be impractical because of the slow drying rate, and the fact that the peeled product has a great tendency to collect dry yard dirt. Dried unpeeled clingstone peaches are very unattractive and unappetizing.

The dehydrated product, according to Nichols (1932), was satisfactory, but the dried fruit brokers in California saw in it no commercial possibilities.

However, in spite of this, a number of foreign buyers were immediately interested and as a result increasing amounts were produced from 1931 to 1936. From that time on, the production has fluctuated around 4,000 dried tons yearly. In recent years the industry has been adversely affected by the War.

Dehydration of Pears

The production of dried pears in the United States has dropped during the war to an average of about 3,000 short tons yearly; the average for 1934-1939 was over 6,000 tons per year. Practically all this fruit is dried in the sun. The Bartlet is almost the only variety used for drying in California, though other varieties are dried in Washington. Laboratory experiments indicate that the Anjou is the only other variety forming an attractive dried product. Dried pears from Lake County, California, have the lightest color because of the suitable climatic conditions both for growing and drying. Other Counties make dried pears of a less bright color, and some pilot-scale experiments have shown that in these counties a dehydrated blanched pear can be made which is of superior quality and color to the corresponding sun-dried fruit.

Properly ripened pears are washed to remove spray residue, by immersion for about 3 minutes in a 0.5 percent hydrochloric acid solution, followed by a fresh water spray. The pears are then cut in half and the calyx, core and stems removed. Then they are sprayed again with clean water to remove calyx fragments and insect excreta. (Compare also Mrak and Long, 1941.)

Blanching in a cabinet requires 12 to 16 minutes. Depth of heat penetration is easily determined by cutting through the blanched half. Pears soften but do not bleed. Sudphuring requires about 8 hours and about 12 to 15 lb. of sulphur for each pair of single cars of fruit. After sulphuring, the fruit is very soft but the skin holds the fruit together and bleeding offers no problem. Dehydration requires 26 to 30 hours at a finishing temperature of 140 deg. F. Peeled pears dry much faster, but slab badly if blanched completely and if highly sulphured. If underblanched peeled pears are dehydrated, the dried product is opaque and chalky white in appearance instead of being transluscent like the sun-dried fruit. Both sulphur dioxide absorption and retention are less favorable than in clingstone peaches. The retention ratio is usually only slightly above 1.0. It is good practice to resulphur the dried product.

Summary

By blanching after cutting we have been able to produce dehydrated apricots, freestone peaches, nectarines and pears of quite similar color and appearance to the sun-dried product, but of superior quality. In other cases, such as the clingstone peach, an entirely new trade commodity is obtained, of very attractive appearance and color.

Because of the high sulphur dioxide retention during dehydration as compared with sun drying, the bulk storage of unprocessed dehydrated fruit is superior as far as darkening is concerned. However, when compared under identical storage conditions the keeping qualities are equal.

Acknowledgment — The authors wish to express their thanks to Victoria A. Haas for assistance with the analytical work.

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Courtesy Fritzsche Bros.

Drying cloves on concrete floors in Zanzibar.

Imitation Clove Oil Effective IN SPICING PICKLES*

Research reveals that imitation clove oil is absorbed as readily by the pickles as the natural oil. Further, the components of the imitation oil are absorbed practically as readily as the natural or imitation oil itself

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IMITATION spice oils have been used industrially to alleviate the shortage in natural spice oils. Also, research studies[3] have shown spice oils to be absorbed by pickles by solution in their waxy coating. To determine whether there is any difference in the quantitative absorption of natural vs. imitation oils and the individual components of an imitation oil in this waxy coating of the pickles, further studies were made and the findings are reported here.

The essential oil of clove was selected for these tests because it is one of the commonest spices used by the pickle maker and it is composed chiefly of three chemically distinct components (terpene, alcohol and ester), with rather wide variations in physical and chemical properties. The imitation oil of clove was formulated to contain 60 percent eugenol, 30 percent terpenes and 10 percent eugenol acetate to duplicate the average composition of the natural oil with respect to these components. The amount of absorption of each of these three constituents was important from a flavor standpoint in that a marked difference in absorption would give a variation from the true clove flavor.

Experimental Procedure

Unspiced (4,500 to 6,000 size) sweet pickles in a liquor testing 35 deg. Brix, 2.3 percent acid and 2.0 percent salt from the same barrel were used throughout these experiments. Large jars with lids were filled with pickles and liquor. The weights of both the pickles and the liquor were recorded separately for all jars.

As indicated in Table I, five different spicing solutions were employed. These were solutions of natural clove oil, imitation clove oil and three clove oil constituents. One set of pickles was spiced at a 1:1,000 dilution and a duplicate set with a 1:2,000 dilution to make a total of 15 jars of pickles and liquor.

The spice oils were added directly to the jars, which were then tightly sealed and shaken. The oil was dispersed by an end-to-end shaking of the jars, which was repeated at least twice each week during a 30-day period. At the end of this time, absorption of the oils by the pickles was considered to be complete[3] and the pickles and liquor were ready to assay.

TABLE I—Control Determinations on the Materials Used for Spicing Pickles

Material used	Percent volatile substance present	Percent volatile substance Recovered	Percent Recovered based on volatility
Natural clove oil	97.8	77.5	78.6
Imitation clove oil	92.1	80.0	87
Eugenol	87.1	88.0	100
Clove terpenes	96.5	96.0	100
Eugenol acetate	86.5	86.0	100

*Journal Article No. 742 (N. S.).
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TABLE II—Distribution of Various Spicing Materials in Liquor and Pickles and the Amount Present in Each After 30 Days.

Dilutions of materials used	Grams of oil in liquor	Grams of oil in pickles	Total grams, pickles and liquor	Percent in liquor	Percent in pickles	Percent recovery in liquor based on control	Percent recovery in pickles based on control	Percent lost or unaccounted for
Natural clove oil (1-1,000).....	0.5101	1.603	2.113	24.2	75.8	17.0	53.5	29.5
Imitation clove oil (1-1,000).....	0.5100	1.714	2.224	23.1	76.9	14.7	49.1	36.2
Eugenol (1-1,000)	0.5058	2.409	2.915	17.4	82.6	12.7	60.4	26.8
Clove terpenes (1-1,000).....	0.5103	2.794	3.304	15.3	84.7	13.1	71.6	15.3
Eugenol acetate (1-1,000).....	0.5410	3.422	3.963	13.5	86.5	13.5	85.6	0.9
Natural clove oil (1-2,000).....	0.1378	0.6867	0.8245	16.7	83.3	8.75	43.6	47.6
Imitation clove oil (1-2,000).....	0.1267	0.6044	0.7311	17.3	82.7	7.26	34.6	58.1
Eugenol (1-2,000)	0.1999	0.4605	0.6604	30.1	69.9	9.99	23.0	67.0
Clove terpenes (1-2,000).....	0.1372	0.4290	0.5662	24.2	75.8	6.86	21.5	72.0
Eugenol acetate	0.1320	1.0142	1.146	11.5	88.5	6.60	57.3	36.1

Determinations

The Clevenger apparatus,[1,2] was used throughout these experiments to determine the amount of volatile oils. Since only the volatile portion of spice oils is measured, determination of the amount of the volatile and nonvolatile portions of the five spice oils used was necessary. This was done by analytically weighing a portion of the oil and determining the loss in weight after heating this portion for 3 hours at 110 deg. C. The data are found in column 1 of Table I.

The percent of pure spice oil which could be recovered from pickle liquors was determined also by placing a known amount of oil in the pickle liquor and distilling it in the Clevenger apparatus. For these determinations a liquor, testing the same Brix, salt and acid as that used in the experimental pickle liquor, was spiced with a 1:1,000 dilution of the pure spice oils. This solution was distilled in the Clevenger apparatus for 20 hours, after which time no more oil collected in the condensation pipette. The pipette was drained, washed well with ether, and the oil extracted by shaking with ether in a separatory funnel. The extraction procedure prescribed by the A.O.A.C. was followed, except that three ether extractions were used to insure complete recovery of the oil collected from the Clevenger pipette. The ether was evaporated by a fan and the remaining water by drying in a sulphuric acid desiccator. The dried oil was weighed analytically, heated for 3 hours at 110 deg. C. and reweighed. The difference was the volatile oil, the percent given in column 2 of Table I being the volatile oil in grams divided by the oil originally added in grams. From the percent volatile and the percent recovered, column 2 of Table I was determined. The figures given represent the percent recovered based on volatility of the spice oil solutions used. Thus the clove oil constituents were recovered 100 percent by the Clevenger apparatus while the natural and imitation clove oil solutions were recovered only 79 and 87 percent respectively.*

After 30 days, the liquor was drained off the pickles and the pickles washed with luke-warm water to remove any oil adhering to the outside. The total liquor and pickle washings were assayed as such by distilling in the Clevenger apparatus. These results are found in column 1 of Table II. The pickles were finely ground in a Clevenger round-bottom boiling flask. Water was added to pickles in the flash, until it was about half full, to aid distillation. Although only an aliquot portion of the entire jar of pickles could be assayed in the Clevenger apparatus, the results given in column 2 of Table II are calculated so as to represent the oil in grams in the total weight of pickles in the jar.

Discussion

The results given in Table II indicate that imitation clove oil is absorbed by the pickle equally as well as the natural clove oil in both the high and the low dilutions.

These results also confirm earlier work[3] which shows that the pickles absorbed most of the spice oil from the liquor. There was apparently no geat difference in the amount of absorption between the three components of the imitation clove oil.

Work[5] on the solubility of the essential oils in whole cloves, when extracted for seven days with the different materials used in pickle manufacture—such as acetic acid, sugar and salt—showed that acetic acid was the best solvent of them all. Two percent acetic acid extracted about 25 percent, while 2 percent salt extracted only about 10 percent and a 35 percent by-weight sugar solution only about 3.5 percent of the essential oils present in whole cloves. A combination of two percent acetic acid, 1.5 percent salt and 35 percent by-weight sugar solution extracted less than 6 percent of the essential oil from cloves. This is approximately the composition of the liquor used in these experiments. Therefore, the solubility of the liquor used to pickle the fermented cucumbers was not very great for clove oil.

A theory was advanced[4] that the spice oils formed a chemical union with, or solution in, the ether-

*Dr. E. H. Hamann of the Fritzsche Bros., Inc. suggests that a part of this difference may have been due to the oxidation and resinification of certain constituents of the natural and imitation clove oil at 110 deg. F. for 3 hr.

Courtesy Fritzsche Bros.

Separating clove buds and stems in Zanzibar.

soluble materials present in the pickles, because the greatest concentration of spice oils was found in those portions of the pickles containing the greatest amount of ether-soluble materials. Since the ether-soluble portion of the pickles has a greater affinity for the clove oil than the liquor in which it is suspended, the greater amount of the oil would be taken up by the pickles. This is the condition which obtained in these experiments, as evidenced by the data in columns 5 and 6 of Table II. About 25 percent (24.2 and 23.1 percent) of the oil was found in the liquor and about 75 percent (75.8 and 76.9 percent) of the oil in the pickles for both the natural and imitation clove oils in the 1:1,000 dilution. In the case of the 1:2,000 dilution of these same oils, the amount found in the liquor (about 17 percent) was even less than that found in the pickles (about 83 percent).

Previous work[3] had shown that in the case of processed dills, a relatively greater amount of oil was absorbed from the high (1:1,000 and 1:2,000) than from the low (1:100 and 1:200) dilutions of the oil. In the experiments with sweet pickles reported here, Table II shows that a relatively greater amount of oil was absorbed by the pickles from the 1:1,000 dilution than from the 1:2,000 dilution. This would indicate that there is a limit to the amount of essential oils that the pickles can absorb from the liquor. It would appear that they absorb a maximum amount of the essential oils from the liquor when the essential oils are present in the liquor in a concentration of about 1:1,000.

The data obtained for the components of the imitation oil show the same general trend as the natural and imitation oils but are not as consistent, especially in the 1:2,000 dilution. This inconsistency doubtless is due to the greater error in recovering the small amount of material from the higher concentrations.

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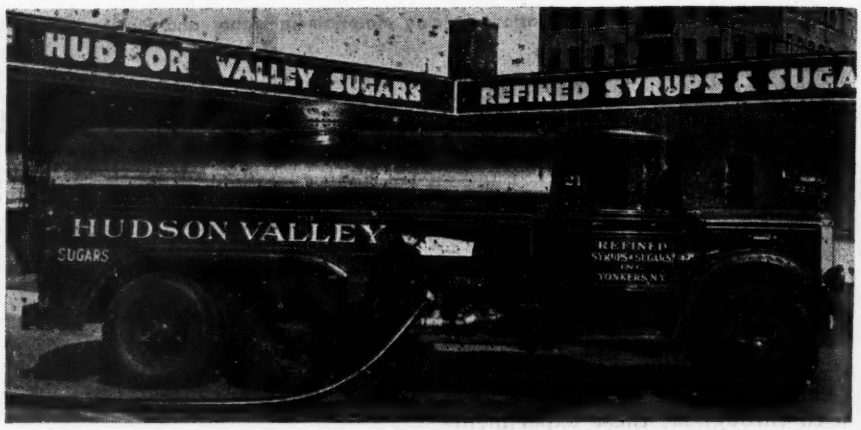


This is one of the 3-axle trucks, carrying a 2,200-gal. tank, used by Refined Syrups & Sugars, Inc., for the distribution of liquid sugars and sirups to food plants in the New York area. This method of distribution has effected savings in labor by eliminating the use of sugar bags and the multiple operations that these bags usually entail.

Liquid Sugar Fleet Cuts Handling Costs

Liquid sweetener is transported to food plants by tank trucks and semitrailers and pumped directly into storage tanks. Cost of handling is less than for sugar in bags

DISTRIBUTION of sugar in liquid form instead of in bags has simplified operations and cut materials-handling costs in some food plants. In the New York area, the liquid sweetener is prepared by Refined Syrups & Sugars, Inc., Yonkers, and transported to the plants in tanks mounted on trucks, and in even larger tanks on semitrailers drawn by tractors. At the food plant, the liquid sugar or sirup is pumped directly into storage tanks by power supplied by the tankers. The liquid sweetener may be delivered to tanks as high as 120 ft. above the street level at a rate of 100 to 175 gal. per minute.

When dry sugar in bags is delivered by ordinary trucks, the first operation is a manual unloading, aided by hand trucks, on platforms sometimes clogged by other vehicles unloading, or congested by goods from previous deliveries. Both conditions result in vehicle delays and increased delivery costs.

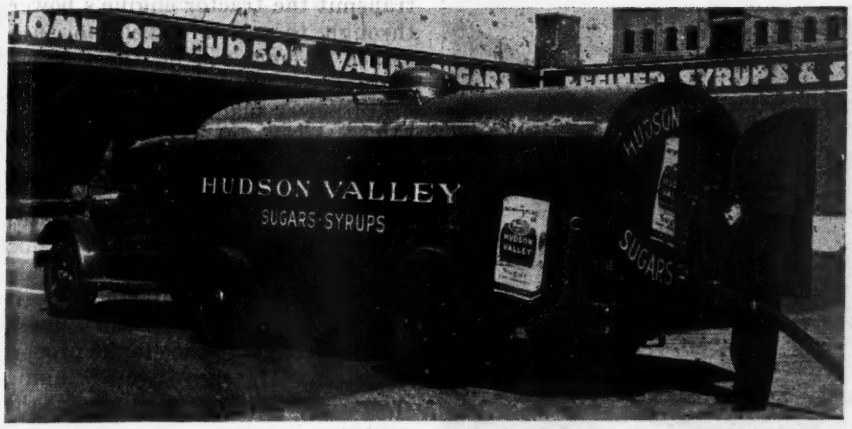
Next, the bags must be moved from the unloading platforms to storage space on the first floor or be lifted by elevators to upper floors. Then the bags must be unloaded and stacked or emptied into bins. Then the required quantities must be measured and supplied to the process. Finally, the empty bags must be stacked for salvage.

In the liquid sugar delivery method, all of these operations are eliminated. The delivery is made, mechanically, direct from the tanker to the plant's storage tanks, thence by gravity or pressure feed to the process.

The trucks and tractors employed are standard commercial models, but the tanks and pumping equipment are designed especially for the products being handled.

The Refined Syrups tank fleet consists of 20 units, of which 8 are trucks and 12 are tractor and semitrailer combinations. The trucks are all three-axle jobs. Three of the trucks are Whites, each carrying 1,500-gal. tanks. The remaining trucks are Macks with 2,200-gal. tanks.

The tractors are all Autocars, each pulling a Heil semitrailer, with a 2,500-gal. tank. In conformity with New York State motor vehicle laws, the Whites have a maximum gross weight of 33,000 lb.; the Macks, 52,400 lb.; and the Autocar tractor-trailer units, 57,000 lb. In addition to the tankers,



The liquid sugar tanks are made of stainless steel and have dust covers over the top filling manholes. The unloading hose is shown at the right and ahead of it, in the rear of the trailer, is the discharge pumping equipment, mounted in its own compartment. This is one of the 2,500-gal. tank semitrailers, its pump powered by a Ford V-8 motor.

the company also operates a fleet of eight tractors and standard box or panel-type trailers for the delivery of granulated sugar in bags. Each of these units carries 400 bags of 100 lb. each. The Heil tanks are all of the same general design with a flat elliptical cross section. Each has but one compartment.

Tank Design

The 1,500-gal. tanks are 13 ft. 2 in. long, 69 in. wide inside and 43 in. high inside. The 2,500-gal. trailer tanks are 17 ft. 2 in. long, 79 in. wide and 49 in. high, inside. The overall length is 20 ft. 8 in., including a 3 ft. 6 in. compartment at the rear to house the pumping equipment.

Both sizes of tanks have interior crosswise baffle plates. The smaller tank has one baffle plate and the larger three. The overall width of all the tanks is 95 in., 1 in. less than the maximum allowable width.

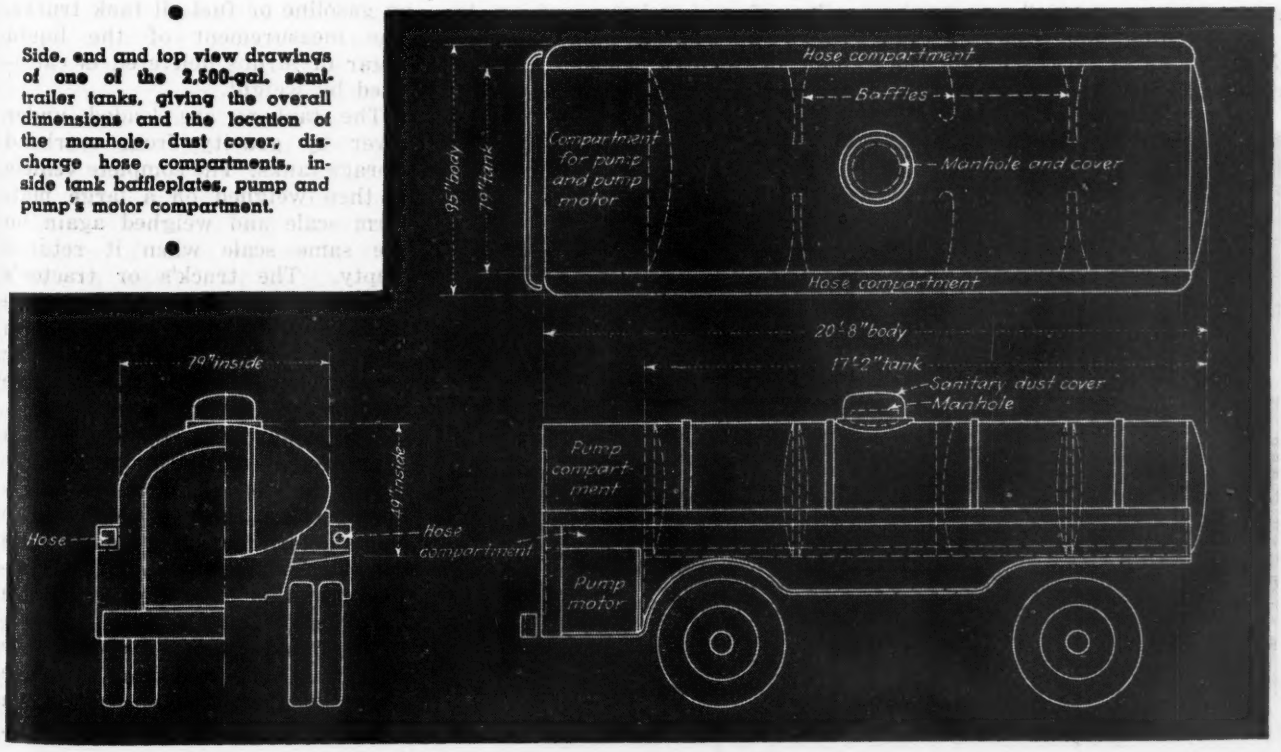
The difference in width between that of the tank itself and the overall width is utilized to provide two longitudinal hose compartments, one on each side of the tank with openings at the rear. These hoses are used to connect the discharge end of the vehicle's pump to the pipe connection at the receiving company's plant. Each tank has one filling manhole at the top center. This is fitted with an air inlet and a dust cover to prevent contamination of the contents in transit. All the tanks are made of stainless steel, highly polished inside and out. No insulation is used.

The liquid sugars and sirups are loaded into the tanks at temperatures varying from 70 to 85 deg. F. Even in extremely cold weather, on hauls up to 150 miles, the temperature of the load does not drop more than 10 to 15 deg. At these temperatures no difficulty is encountered, without tank insulation, in pumping to customers' storage tanks located as high as 120 ft. above ground level.

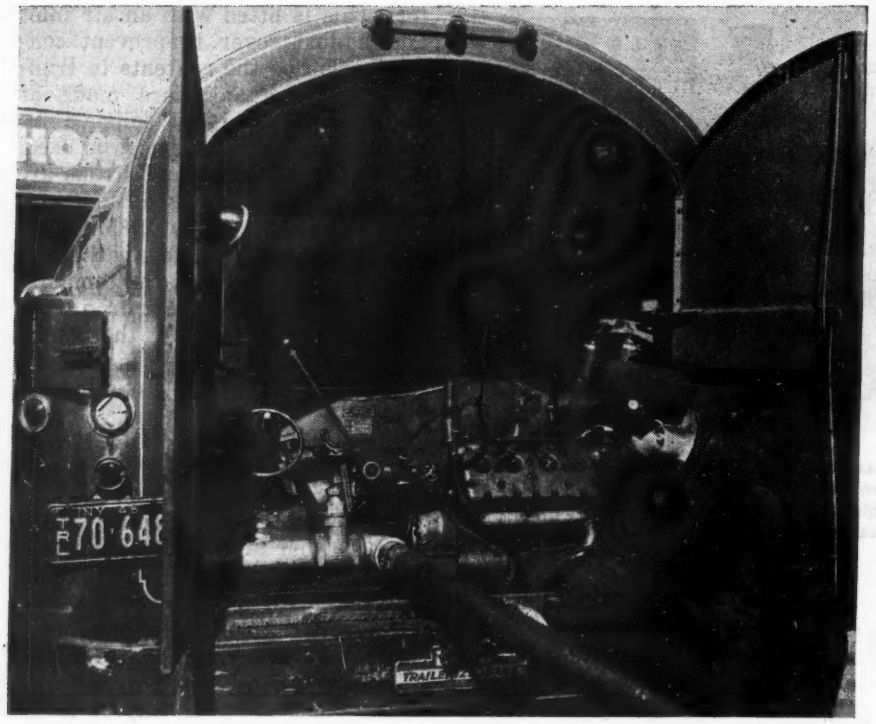
Delivery from the tanks is facilitated by a substantial pitch of the tank bottom toward the pump suction. The tanks may be readily washed with hot or cold water. However, the company attempts to keep the trucks and tractors handling the same type of sirup on the same runs. In this way it is not necessary to wash the tanks after each delivery, but only occasionally.

Pump Drives

The power for operating the discharge pumps on the trucks is taken from the trucks' own propulsion engines. In the case of the trailer tanks, auxiliary engines have to be provided. On the trucks, the power is transmitted to the pump through a conventional type auxiliary transmission, or gearbox. The pump on the truck is located



Side, end and top view drawings of one of the 2,500-gal. semitrailer tanks, giving the overall dimensions and the location of the manhole, dust cover, discharge hose compartments, inside tank baffleplates, pump and pump's motor compartment.



The Ford V-8 engine and transmission, shown in this rear view of one of the semi-trailers, drives a Foster rotary pump which delivers the liquid sugar direct to storage tanks as high as 120 ft., at the rate of 100 to 175 gal. per minute.

below the tank on the right side of the frame. It is enclosed in the tank sheathing and is reached by doors, which are closed while the vehicle is in transit.

The pump used on both the trucks and trailers is of the same make, type and size. It is a Foster rotary pump and has a capacity of from 100 to 175 gal. per minute. The pump operates under a maximum pressure of 100 lb. per sq. in.

The suction line from the tank to the pump is of a nonrigid construction. This permits independent movement between the tank and pump, as when the pump is vibrating under action, or when the truck frame is subject to wearing under uneven road conditions. Thus, strains or leaks in the discharge line between tank and pump are minimized.

On the trailer tanks, the tractor engine is not used to drive the discharge pump because of the difficulty of transmitting power between two separate units connected only by a fifth wheel. Although mechanisms have been developed to transmit the tractor engine's power through the fifth wheel, no such device is employed on the tractor-trailers. Instead, an entirely separate power plant is provided.

This power plant is a complete Ford V-8 engine with its 3-speed transmission and water radiator and fan. The engine is mounted crosswise, at the rear of the tank, and is enclosed in its own separate compartment. In outside appearance, the compartment looks like a continuation of the tank proper. Access is through two swinging doors opening outward from the center.

The Foster rotary pump is located on the left side of the compartment, looking toward the front of the tank, and is directly connected to the transmission shaft of the Ford engine. The speed of the pump is determined by any one of the three forward speeds of the transmission and the speed selected is obtained through a standard Ford gearshift lever. When the load has been discharged, the gearset is thrown into reverse. This causes the pump to suck out all the liquid sugar or sirup remaining in the customer's line.

The Ford engine installation is complete with battery and starter and ignition and starter switches. A separate gasoline fuel tank is also provided. This is located crosswise on brackets between the end of the tank and the engine itself. None of the tanks is equipped with flow meters similar to those used on gasoline or fuel oil tank trucks. The measurement of the liquid sugar or sirups delivered is calculated by weight.

The tankers are loaded under cover by gravity from overhead storage tanks. The complete vehicle is then weighed on a large platform scale and weighed again on the same scale when it returns empty. The truck's or tractor's gasoline tank is filled before the loaded weighing and filled again upon the return. Thus the customer is not charged with the gasoline used on the delivery trip.

The customer is supplied with a copy of the full and empty weight tickets and is billed on the difference between the two weights. The solids determination is made by the company's laboratory prior to delivery and is also checked by the customer.

The liquid sugar delivered by the tankers is converted from raw cane sugar and processed so that it can be held indefinitely in liquid form.

Plant of Refined Syrups & Sugars, Inc., Yonkers, N. Y.

Cutting Costs With Volts

Contrary to the opinion of many, economical distribution voltage for the medium-size plant is 4,160 volts. The author explains why and gives pointers on electric power utilization. Money saved on power is profit

By D. L. BEEMAN, Engineer, Industrial Engineering Division, General Electric Co., Schenectady, N. Y.

WHICH is the more economical basic distribution voltage for a new, medium size industrial plant, or an existing plant being reconverted, modernized, or expanded—2,400 or 4,160 volts?

Many operators will say 2,400 volts, and for an apparently logical reason. A sizable percentage of the total electric power in many industrial plants is consumed by motors ranging from 40 to 500 hp. Since motors in that range can be connected directly to 2,400-volt circuits, it is commonly believed that the lowest cost electrical system—including power generation, distribution, and motors and control—can be obtained by distributing purchased or generated power at 2,400 volts. A review of the factors which influence system cost indicates that such is not the case.

Advantages of 4,160 Volts

Studies of specific systems show that, as far as over-all electrical system costs are concerned, it is nearly always less expensive to use 4,160 volts primary or generation voltage rather than 2,400 volts, and to operate most motors of 200 hp. and less on 460- or 575-volt circuits. This conclusion is based on the data shown in Fig. 1. The derivation of these curves is explained in detail later in this article.

The 4,160-volt system offers many important advantages other than lower cost. Short-circuit current bottlenecks are not reached as readily, as higher system short-circuit kva. can be tolerated in 4,160-volt systems, compared with the 2,400-volt systems, before it is necessary to introduce reactors or to resort to special combinations to reduce short-circuit currents. In general, fewer primary feeder positions and less cable are required for the 4,160-volt distribution system compared with one using 2,400 volts. This reduces the space required for housing the switchgear, and also the space required for conduits for the primary cable.

From the standpoint of safety it is generally concluded that there is substantially no difference between the commonly used 2,400-volt delta system, which normally is not grounded, and the 4,160-volt system with the neutral grounded according to modern recommended practice.

In some areas 4,800 volts is the standard primary voltage. The basic factors presented here are not substantially altered whether the voltage is 4,160 or 4,800 volts.

In studying the economics of this problem, certain basic equipment and system elements were considered. Standard squirrel-cage induction motors are by far the most common. Therefore, these motors have been considered as a basis of comparison. The curves in Fig. 1 are plotted for 1,800-r.p.m. motors.

There has been a tendency to totally disregard short-circuit-current interrupting duty imposed on motor starters for short circuits which may occur on the load side of the motor starter. Adequate interrupting capacity is desirable in the motor starters to safely and quickly open these short-circuit currents. When a fault occurs on the load side of the motor starter and the latter does not have adequate interrupting capacity, it may fail and endanger nearby personnel and property. It may also cause the feeder circuit breaker to be tripped out, thus dropping service over a large area of the plant and, as a consequence, substantially affecting production. Therefore, only modern combination motor starters are considered in this comparison.

System Factors

To use 440- or 550-volt motors in a plant in which the primary or generation voltage is higher than 600 volts requires a transformation to less than 600 volts for these mo-

(*Turn to page* 174)

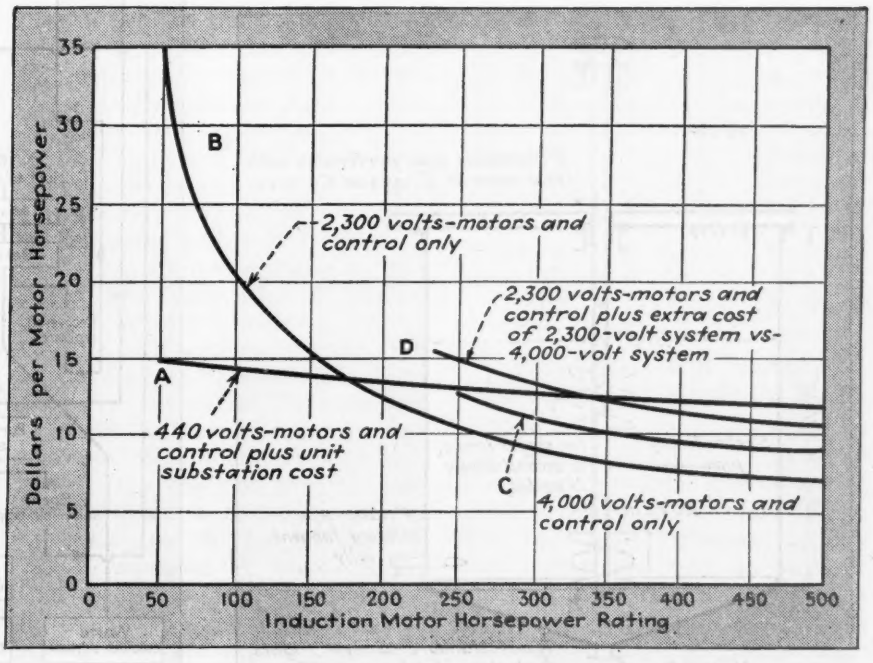


FIG. 1—Cost curves for different systems of electric distribution.

Molasses Distillers Can Produce Large Quantities of Yeast

Potential is 25 to 50 million pounds of high-vitamin yeast annually—yeast which is on a par with brewers' yeast and which is in great demand. Not only the economic possibilities, but the details of the process and equipment, are given here

By GUSTAVE T. REICH, Pennsylvania Sugar Co., Philadelphia, Pa.

OWING to its high vitamin content, distillers' yeast is on a par with brewers' yeast and is in great demand. It conforms to the specifications of the Association of Feed Control Officials.

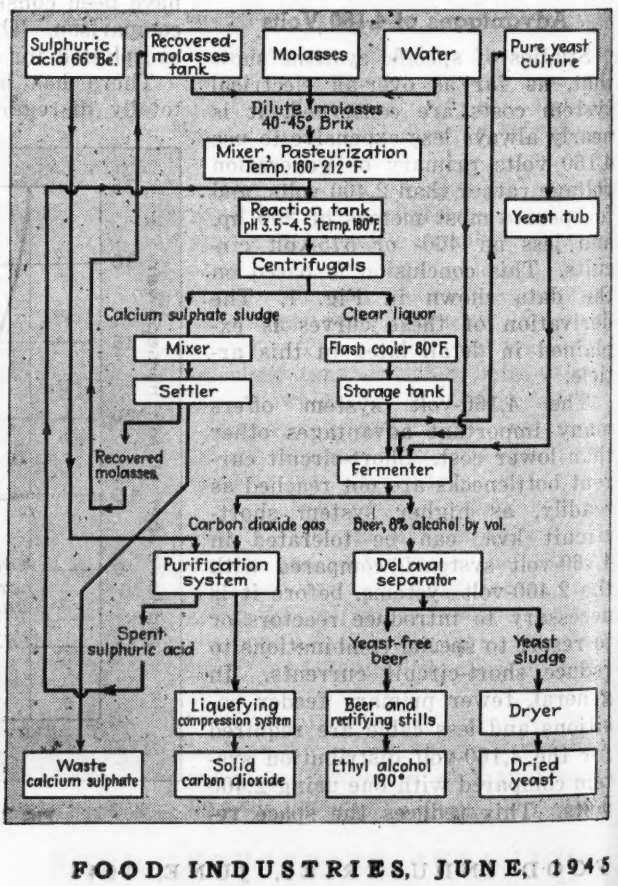
Recovery of the yeast in molasses distilleries is not only a war problem but is certain to be a postwar problem. A number of plants which were, in the main, government financed are now producing 85 million gallons of synthetic alcohol for the manufacture of synthetic rubber. If after the war these plants are turned over to the present operators, as suggested in the Baruch-Hancock Committee's report, and if the postwar rubber situation will not warrant the production of large quantities of synthetic rubber, then large quantities of synthetic alcohol will be available for industrial purposes.

Furthermore, other government-financed plants—such as those for methanol, glycols and isopropyl alcohol—will make further inroads after the war into the alcohol business (particularly in antifreeze and solvents). Consequently, the molasses distilleries must appreciate the situation and prepare for very keen competition after the war. Being able to produce a high-grade yeast and also to produce yeast exclusively or merely as a byproduct in the manufacture of alcohol, they will be in a position to take advantage of the market, depending upon the price of molasses, alcohol and yeast.

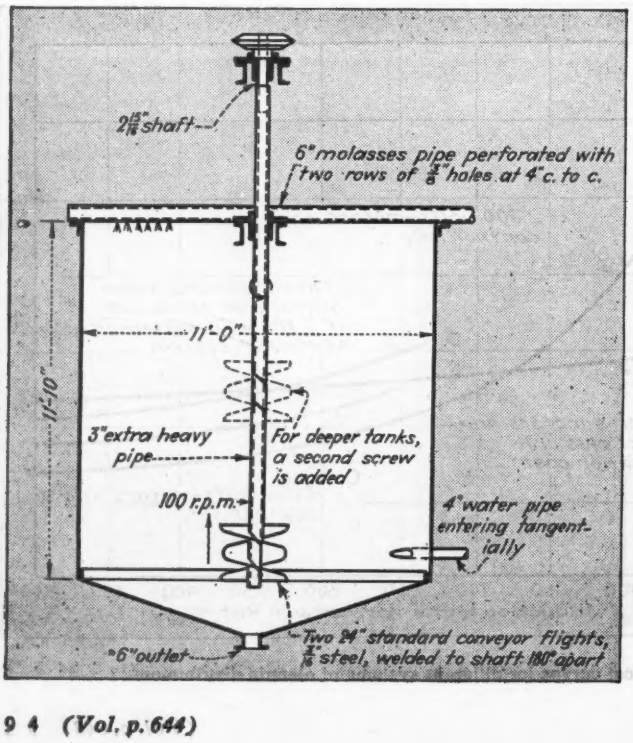
The demand of the government for dried yeast, as well as the increased consumption of this product for feeding purposes, gave great impetus to the recovery of this byproduct in the breweries.

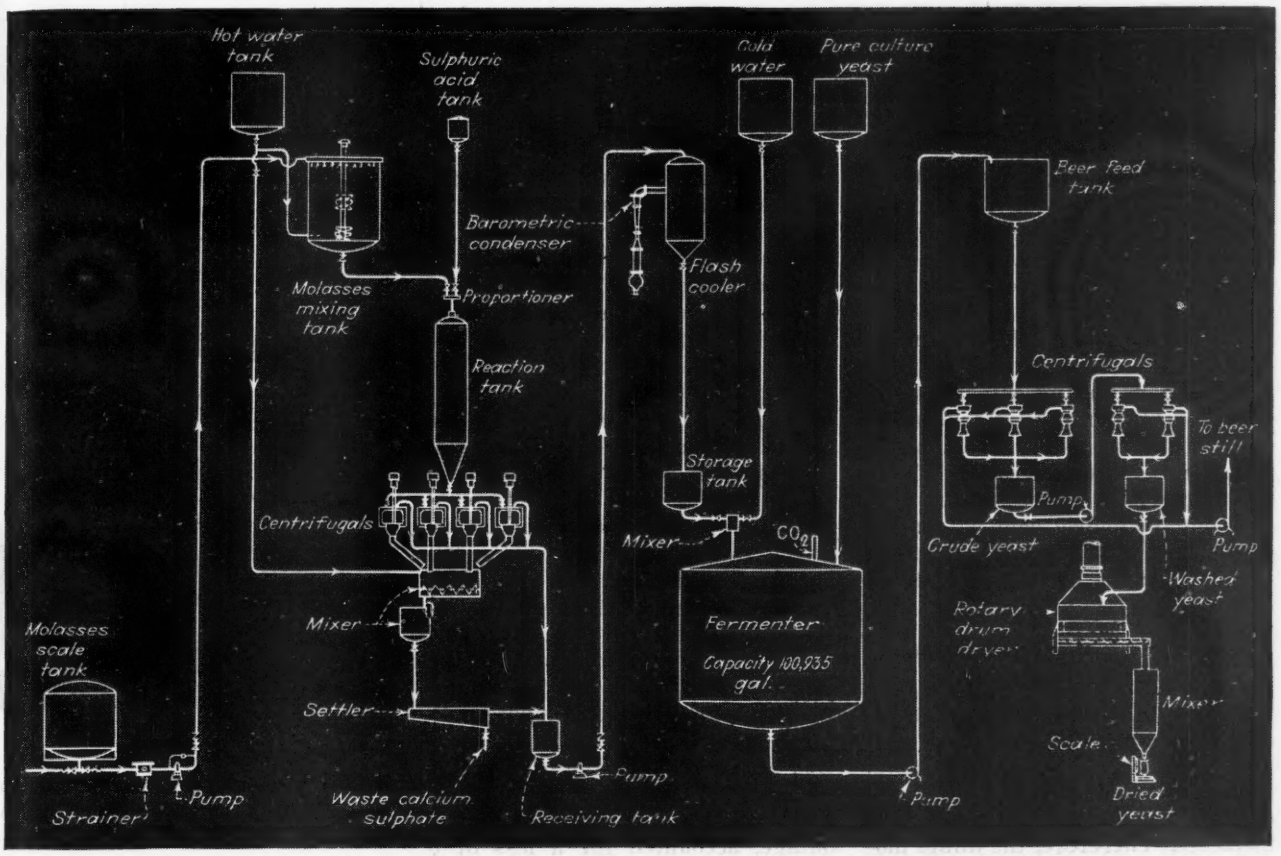
Breweries, either independently or by pooling their interests, and aided by the government, established centrally located drying plants for the recovery of yeast. It is estimated that with a production of 50,000,000 bbl. of beer, approximately 40,000,000 lb. of dried yeast could be recovered yearly.

Process flow diagram for the production of dried yeast from distillers' molasses, showing also carbon dioxide and ethyl alcohol recovery. (At right.)



Molasses mixer, 8,500-gal. capacity, with screw agitator. (Below.)


2 15/16" shaft
6" molasses pipe perforated with two rows of 3/8" holes at 4" c. to c.
11'-0"
11'-10"
3" extra heavy pipe
For deeper tanks, a second screw is added
100 r.p.m.
4" water pipe entering tangentially
"6" outlet
Two 24" standard conveyor flights, 1/4" steel, welded to shaft 180° apart



Equipment flow diagram for the production of dried yeast from distillers' molasses.

Distilleries also require yeast for the fermentation of molasses, and as they are producers of large quantities of ethyl alcohol, great quantities of yeast are available. Up to the present, these distilleries have not been recovering this yeast in a pure form. According to the quality of molasses fermented, they produce ¼ to ½ lb. of yeast on a dry basis per gallon of 190-deg. proof alcohol. A distillery processing 50,000 gal. of blackstrap molasses, manufacturing 20,000 gal. of 190-deg. proof alcohol daily, could recover at least 1,800,000 lb. of dried yeast yearly. We can easily surmise the potential possibilities of such a source of supply. Assuming that the molasses distilleries produce 100 million gallons of 190-deg. proof ethyl alcohol annually, they could supply 25 to 50,000,000 lb. of pure dried yeast per year without impairment of the yield of alcohol. Therefore, it is surprising that such a potential source as the molasses distilleries has been overlooked altogether.

According to the author's process, for which patents have been granted and further applications applied for, all the yeast produced during the fermentation of molasses is recovered. Hitherto, molasses of 84-deg. Brix was pasteurized and diluted with water to a density of 18 to 20 deg. Brix so as to give a high percentage of alcohol. The molasses contains sugar in two forms. One is sucrose, the other invert sugar. The latter is formed when sucrose undergoes hydrolysis, or inversion. The invert sugar ferments easily when yeast is added, while sucrose does not ferment. Therefore, the distilleries usually add 1 gal. of 60-deg. Baumé sulphuric acid per 1,000 gal. of mash to bring about inversion of the sucrose. Finally, the right amount of yeast food and pure yeast is added (from 3 to 5 percent by volume of the mash) and by controlling the fermentation, the cycle can be completed within 48 hours.

During the manufacture of cane sugar, large quantities of lime are used to prevent inversion of the sugar, which would reduce the yield of the desired sucrose. When the juice is concentrated in special evaporators, the raw sugar crystallizes out. The liquor which is separated from the raw sugar in centrifugals has a sugar content of approximately 50 percent and is called "molasses." Some of the lime used in the treatment remains in the molasses, from which the recovery of sugar is not profitable. When the molasses is fermented, lime precipitates out, contaminating the yeast, also depositing as a hard scale in the dealcoholizing (beer) still and evaporators.

According to the author's process, up to 88 percent of this lime is removed during the pasteurization of the molasses and before fermentation. This is the crux of the whole process and permits the recovery of a high-grade yeast. The process consists of these steps:

a. Diluting, pasteurizing and treating the molasses with sulphuric acid.

b. Completing the reaction with sulphuric acid for the formation of calcium sulphate (gypsum) and separating the precipitate from the molasses.

c. Cooling the calcium sulphate-free mash, further dilution and fermentation of the molasses and separation of the yeast from the beer.

d. Washing, drying and packing of the yeast.

Pasteurizing and Treating Molasses with Sulphuric Acid

Molasses of approximately 84 deg. Brix is diluted with an equal volume of hot water and heated to 180-200 deg. F. in a mixing tank. This tank is of 8,500-gal. capacity and is provided with an agitator shaft, in the center, fitted with two pieces of screw-conveyor blade. Perforated pipes are placed crosswise on the top, through which the

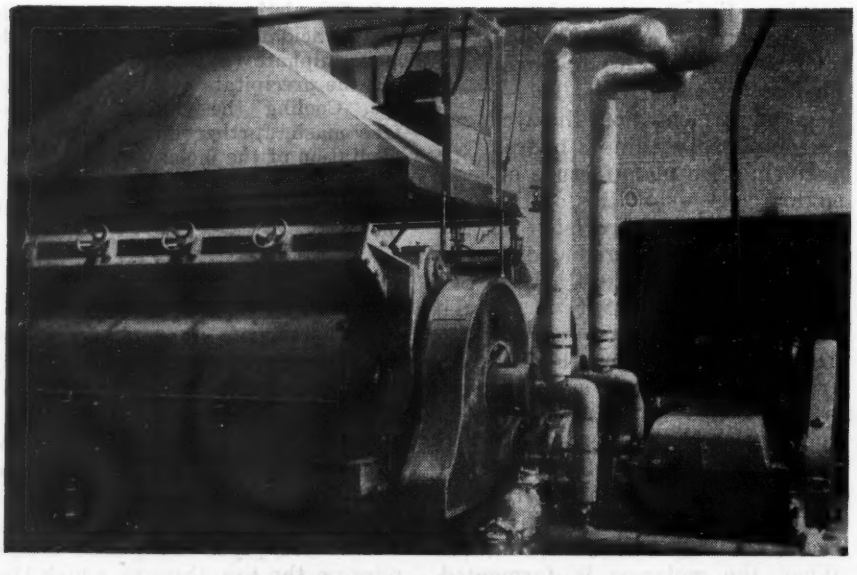
molasses flows in a fine stream, while hot water enters tangentially at the bottom. Provision has been made for the injection of the steam for pasteurizing purposes. The mixer operates continuously, while the hot, diluted molasses of 40 to 45 deg. Brix passes to the proportioner, which regulates the ratio of the molasses and concentrated sulphuric acid. The cost of the acid is negligible, as it is first used for the deodorization of the carbon dioxide gas liberated during the fermentation of the molasses and the gas converted into solid carbon dioxide.[1] The molasses, which has a hydrogen ion concentration of approximately 5.5 pH, is treated with sufficient sulphuric acid so that it will have a 3.5 to 4.5 pH, at which it will yield the largest quantity of calcium sulphate precipitate.[2]

Separating the Precipitated Calcium Sulphate

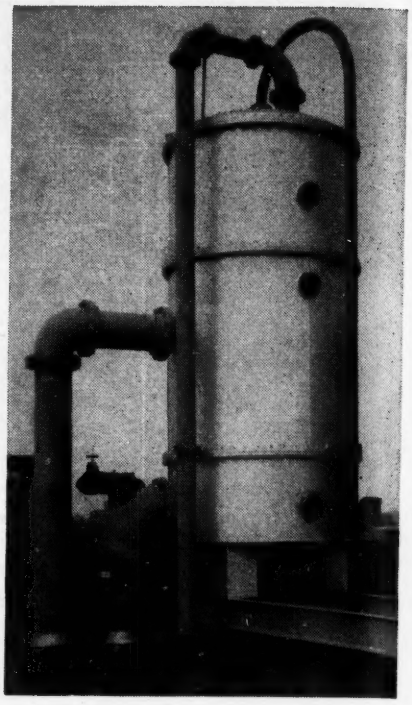
It has been found that the reaction between the sulphuric acid and lime (CaO) is not very rapid, owing to the buffer action of the organic compounds present in the molasses. Therefore, the dilute molasses and sulphuric acid mixture passes into the reaction tank, so that within one hour all the lime in the molasses combines with the sulphuric acid, thus forming large, easily separable calcium sulphate crystals. The hot liquid now passes to centrifugals provided with specially designed 40x24-in. solid stainless steel baskets which rotate at 1,150 r.p.m. They are run batchwise on a cycle of about 2½ hours. The calcium sulphate is collected in the basket, and at the end of the cycle is plowed out and is dropped into a mixing tank, where, after proper dilution, the very dilute molasses is separated in a settler from the calcium sulphate. The liquid is returned to the mixing tank, while the calcium sulphate is wasted.

A distillery processing 50,000 gal. of blackstrap molasses, containing 1.5 to 3.0 percent of lime (CaO), will remove, according to the above described method, from 6,000 to 12,000 lb. of calcium sulphate daily, depending upon the quality of molasses fermented. A yeast obtained from an untreated molasses contains up to 60 percent of ash, while the treated molasses yields a yeast with an ash content of 6 percent. In the regular yeast plant, the presence of lime is not as troublesome, owing to the great dilution in the fermenters and absence of alcohol. In the distilleries, the high concentration of the mash and high ethyl alcohol content in the beer are the contributing factors for the precipitation of the calcium sulphate during fermentation. Before the adoption of this system, the progressive plugging of the deck perforations in the beer still, together with the outage, accounted for a loss of 5 percent, or 350,000 gal. of alcohol per year.

The clear molasses liquid from the centrifugals is pumped to a flash cooler, set up like a barometric condenser, which reduces the temperature to 78 deg. F. by the aid of a steam-jet pump. After cooling, it is used partly for making yeast, while the remainder is diluted continuously with cold water to a density of 18 to 20 deg. Brix and flows to the fermenters, where yeast is added and the fermentation completed within 48 hours.



Double-drum dryer for drying yeast.



Flash cooler.

The fermentation product, called "beer," contains 8.5 percent of alcohol and a large quantity of high-grade yeast. The beer containing the yeast is now treated in a manner similar to brewers' yeast; that is, it is passed through several high-speed (4,500 r.p.m.) DeLaval separators with 7½-hp. motors, which deliver on one side a heavy yeast sludge and on the other side the clear beer ready for dealcoholization. The yeast sludge is washed and recentrifuged several times and then passes to a double-drum dryer, which consists of a pair of 42x100-in. cast iron drums in which a steam pressure of 60 to 80 lb. is maintained. At first, great difficulties were encountered in properly drying the yeast and of producing a high-grade material because of the great variations in the quality of molasses fermented. Very careful control and special technics were required, otherwise the yeast would have a gummy, sticky consistency (it is very hygroscopic) and could only be removed with great difficulty from the drums. The knives scored the drums and the product was badly burned.

While there are many problems to overcome, here is a source of sizable quantities of high-vitamin, high-grade, byproduct yeast.

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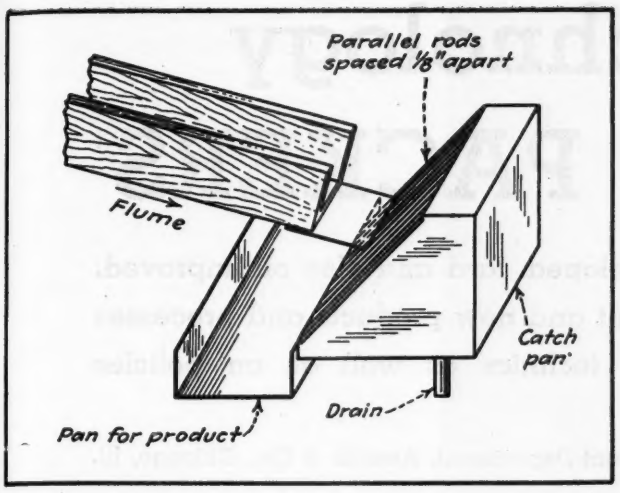
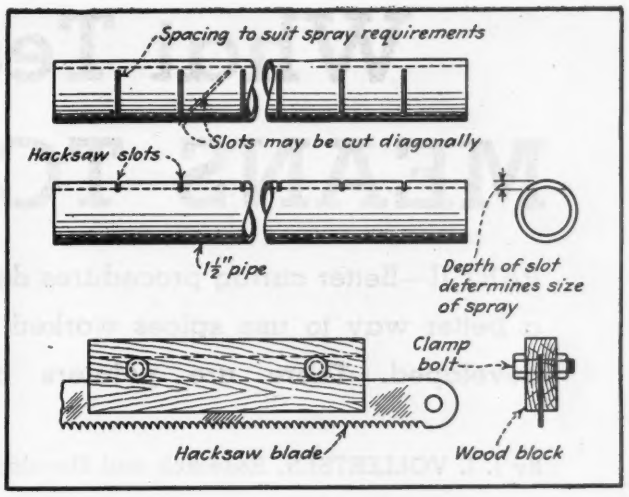


Simple dewatering shoe removes liquids from solids when both are discharged from a flume. It has application in fruit and vegetable canneries, quick freezing, dehydrating and other plants.



A spray can be made quickly by sawing slots in a length of pipe. To regulate the depth of the slots, the hacksaw is fitted with an adjustable stop.

SHORTCUTS In Plant Operations

By FRED H. DELLWO, Food Engineer,
Ball Brothers Co., Muncie, Ind.

Among the unsung "heroes" are the little gadgets that simplify, improve or speed production operations. Here are two such devices, a dewatering shoe and a spray pipe made with a saw

DEVICES developed by hard working production men often pass unnoticed because they are not intricate in design or operation. Frequently, the device is nothing more than a small trip lever that automatically guides or regulates the flow of materials or containers. Its cost may have been insignificant, yet it may serve faithfully to eliminate the need of a manual operator or speed up production. We cannot help but feel that gadgets are worthy of greater attention; we describe two here.

"Dewatering Shoe"

The first idea is a simple method of removing liquids from solids when both are discharged from a flume. The idea finds application in fruit and vegetable canneries and in pickle, olive packing, quick freezing and vegetable dehydrating plants. In all of these plants, flumes may be used at some point or other to wash the product, cool it or simply convey it. The simple device pictured in the sketch as a "dewatering shoe" does an efficient job of water removal. Its effectiveness lies in the fact that the direction of product is reversed at the point where it strikes the "shoe" and the velocity of the water carries it through the grid. Materials needed for the dewatering shoe are available in most plants and consists of 20-gage galvanized sheet, solder, rivets and metal rods of ⅛ to 3/16-in. diameter. Welding rods serve as excellent material. In the sketch, the "shoe" is shown discharging onto a pan, but it will work equally well when discharging onto a conveyor belt where the product is to be inspected or sorted. While only the basic idea is presented here, users of this device will find many other useful applications for it.

Slotted Spray Pipe

The second idea is a simple one that can be applied in a hurry yet is effective enough to warrant wide use. The idea will appeal to those who have tried to rig up a spray pipe in a hurry by drilling a number of small holes in it. Usually the drill breaks when the job is about half done, and then when the pipe is finally ready, it does a very ineffective job of spray distribution. The small-diameter round sprays use large volumes of water for the small area they cover. They plug readily and are hard to clean.

On the other hand a hacksaw is a plant mechanic's indispensable tool and is always at hand. As shown in the sketch, a simple and effective spray pipe can be rigged up in a hurry with nothing more than the pipe and a hacksaw. Slots may be cut diagonally or crosswise to obtain almost any spray needed. Since the depth of the slot determines the size of spray, a little care should be exercised in the cutting job. If exactness is desired, an adjustable stop can be made of wood, as shown in the sketch, and fastened to the back of the hacksaw blade. Since many plants are today finding it necessary to employ untrained mechanics, the use of this idea may well serve to prevent lost time and many broken drill points.

At the same time, the resultant device will do a better job of washing or spraying with less water.

$10 for Your Idea

FOOD INDUSTRIES will pay $10 for each item describing, and illustrating with a drawing or sketch, a food plant operating shortcut if the item is accepted for publication by the editors. The device must be one actually made and used successfully in a food factory. Submit your items to Food Industries, Editorial Department, 330 West 42nd St., New York 18, N. Y.

What Technology MEANS TO PACKERS*

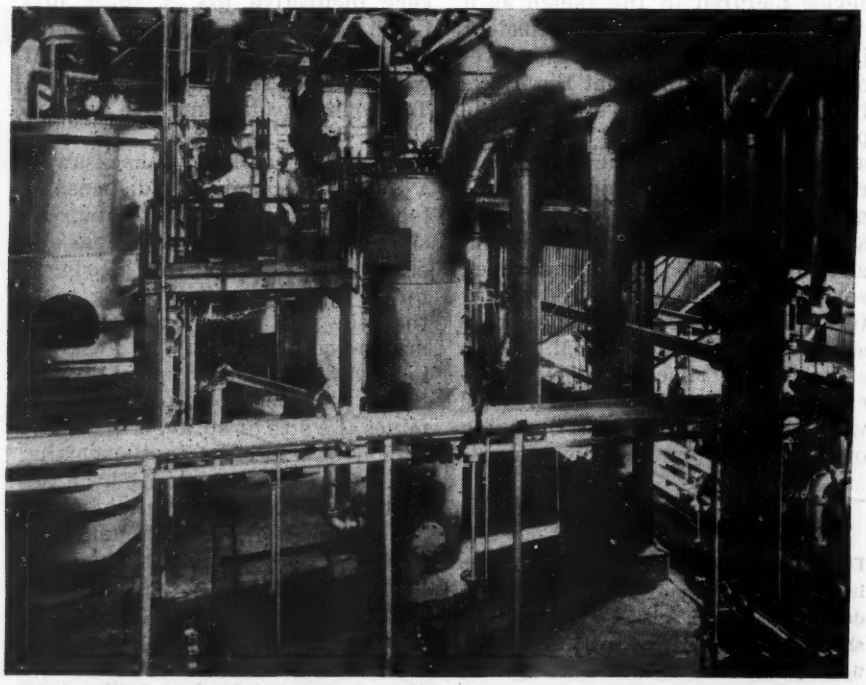
PART II—Better curing procedures developed, lard and oleo oil improved, a better way to use spices worked out and new products and processes developed. There are pointers on technics as well as on policies

By J. J. VOLLERTSEN, Research and Development Department, Armour & Co., Chicago, Ill.

EARLIER in this paper we mentioned the establishment of the Bureau of Animal Industry. Originally, in the curing of meats we were permitted to use only saltpeter or potassium nitrate as a color fixative. When potassium nitrate became scarce, the BAI permitted us to use sodium nitrate. Inasmuch as the nitrite is the active substance in forming the red color which characterizes cured meats, the old cures were dependent upon nitrate-reducing bacteria to form the nitrite from the nitrate. Obviously, under such circumstances the results might not be uniform, since the number and activity of the bacteria present in the cures, as well as cellar conditions, might vary. One of the packers attempted to overcome this by adding a nitrate-reducing organism to the curing vats. For a number of years the packers tried to get the government to permit them to use sodium nitrite, but a great deal of work was required to convince the BAI that this was the proper thing to do. About 1920 this permission was granted, and since that time sodium nitrite by itself, or a combination of sodium nitrate and sodium nitrite, has been used in curing meat products.

We might also illustrate the type of work carried on by the meat packer's research laboratory by describing the change which has occurred in the curing of hams. Under the old system, or what is now known as the "long cure," hams were immersed in a curing pickle after having a small amount of curing pickle forced into the flesh and allowed to remain until the curing ingredients penetrated by osmosis into all parts of the ham. The last portion to be cured was the section just below the fat layer because the cures did not penetrate very rapidly through this layer. The time required for a complete cure was about 3½ days per pound of product, which means that a 15-lb. ham would remain in cure for at least 50 days. When the ham was removed, the salt content was not very uniform and was very heavy on the flesh side. This oversalting required soaking for a period of time, followed by a draining period. The result was that it would require more than two months to completely cure a 15-lb. ham. Even then, in many cases, the ham was quite salty.

In recent years, a new method has been developed whereby the curing solution is pumped into the ham through the arteries so that the "cure" penetrates all of the capillaries, and the entire inside of the ham contains a uniform amount of curing ingredients. These hams likewise are put into curing vats, but the entire curing period is completed in from 10 to 15 days. This method has resulted not only in an immense saving of space but in a better opportunity for the sales department to meet sudden demands for cured hams. And it has produced a milder flavored, more uniform quality product from the standpoint of the consumer.



Fat and oil hardening calls for the making of highest quality hydrogen gas by the most economical method, generally by the "steam-iron" process. Although remote from meat packing, hydrogen gas-making for use in fat and oil hardening means gas-plant engineering and technological control.

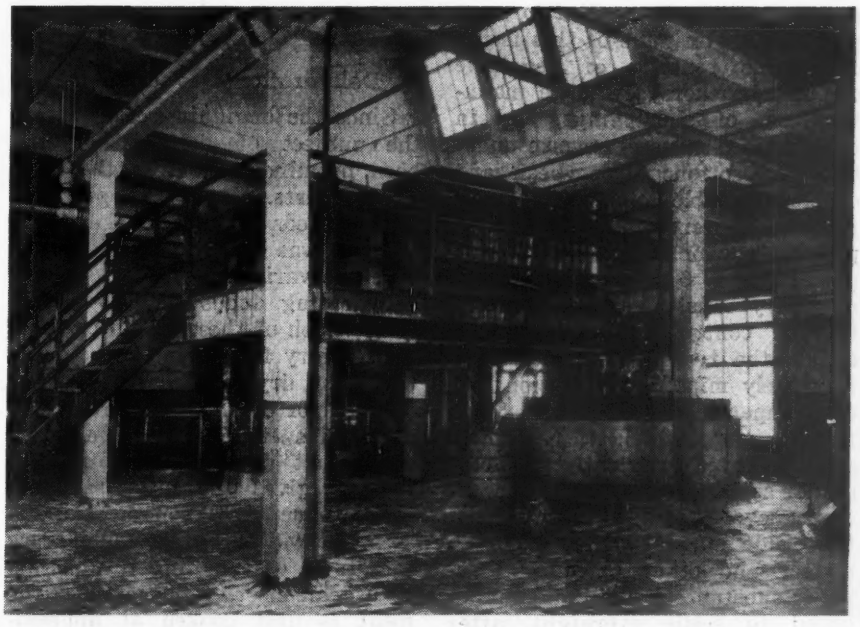
*Based on paper read before the January, 1915, meeting of the Chicago Section, Institute of Food Technologists.

Better Lard, Oleo Oil

A great deal of work has been done on the improvement of lard. When hydrogenation was applied to the hardening of fats and oils, the packers naturally were interested in the possibility of using this process in the production of a better or different type of lard. After considerable work, one of the packers put out a hydrogenated lard. It has been on the market continuously for many years and has received considerable consumer acceptance. Owing to the methods used in producing lard, the finished material has a distinctive flavor which is objectionable to some consumers.

As a result of technological research, a lard product has been developed which has been given a higher melting point by partial hydrogenation, has been deodorized, and has been stabilized against rancidity by the addition of an antioxidant. This product has likewise been on the market for some little time and apparently has found a very favorable consumer acceptance. The use of antioxidants in lard and other types of shortening manufactured by the packers is receiving considerable study at the present time, and a number of quite satisfactory antioxidants have been developed. The Army is a large user of fats, and the Quartermaster's Laboratory has been interested in a stable lard. They, as well as the regional laboratories of the Department of Agriculture, in connection with the packers, are carrying on a series of experiments to determine the best type of antioxidant to use and how best to produce a lard of uniform high-melting point.

Oleo oil is a product which is used largely in the manufacture of margarine and to a considerable extent in the candy industry. It is made by washing and rendering the internal fats of beef carcasses at a very low temperature. The resulting rendered fat, known as "oleo stock," is settled to remove moisture and then is put through a treatment for separating the harder from the softer portions. The former is ordinarily known as oleo stearine and the latter as oleo oil. For many years the method used consisted of taking the rendered stock, placing it in large wooden trucks called "seeders," which were then allowed to stand in a room at a temperature of 98 deg. F. for almost a week. During this time the harder fats crystallized and the oil was removed from them by hydraulic or knuckle presses. Several years ago, we undertook some experimental work to see whether the crystallization could be accomplished by a continuous process. After considerable changes in the type of equipment used, a successful separation of stearine crystals was obtained immediately after the rendering and settling process was completed. The problem of a better method of separating the stearine from the oil is still before us.



After hardening, the treated fat or oil must be handled and filtered under conditions conducive to the removal of all traces of the catalyst used, if subsequent discoloration and rancidity development are to be held to the minimum.

New Products, Processes

Under the heading of "new products and new processes," we might mention briefly one or two items. Much of the blood produced in some packing plants is manufactured into what is technically known as "blood albumin." To make a product of this kind, the blood must be caught immediately after it leaves the animal, treated with a chemical to prevent coagulation and then separated into blood corpuscles and serum. Formerly, this blood was caught in ordinary buckets which contained the necessary chemical, either sodium citrate or ammonium oxalate, and then was poured into a tank, from which the further processing was carried on.

After considerable work, one of our men developed a method of catching this blood in a trough and then recirculating it until the chemical was thoroughly mixed with it, thus eliminating the labor of five or six men. This was a rather difficult problem, inasmuch as it was necessary to prevent hemolysis and a discoloration of the serum due to bruising of the corpuscles. We also attached a proportionometer to the equipment so that the same percentage of chemical is present in all of the blood collected. This was not true previously, the amount of blood in the animals varies as much as 10 lb. per bullock. In addition to releasing the labor which we mentioned, we now obtain an average of from 17 to 18 lb. of blood per animal as compared to 10 to 12 lb. in our previous operations.

We have mentioned before that the packing industry has a large volume of inedible fats and greases for disposal. One of the outstanding new developments by the technologist of the packing industry has been the manufacture of fatty acid derivatives of various kinds from these inedible products. This project has expanded to such a great extent in the last few years that it is a division by itself and probably should be classed as a chemical division. It has also stimulated work along the same lines outside of the packing industry, and there seems to be a great future for these materials. Some of these products have been found useful in the plastic industry, in the flotation of ores and in insecticides.

Technologists in the packing house must be on the lookout for new inventions or processes developed by outside organizations to

see if they can be applied to meat packing. An example of this is the continuous refining of vegetable oils. The packers are large manufacturers of shortenings, and in this connection use immense quantities of cottonseed, soybean and other vegetable oils. For many years these were refined by a batch process in which the crude oil was placed in a 60,000-lb. tank, the necessary caustic — as determined by the control laboratory — was added, the two constituents were intimately mixed by agitation and the temperature slowly raised until the soap, which was formed, conglomerated sufficiently to assure proper settling. This refining method removed the fatty acids from the crude oil, as well as coloring matter and other extraneous organic substances. The tank was allowed to settle overnight, after which the oil was drawn off and placed in storage tanks for bleaching and further processing. Some years ago, attention was called to the possibility of refining this oil by the use of centrifuges. In this system, the oil is pumped through a small mixing box, to which the proper amount of caustic is added through a proportionometer. The mixture is heated in a heat exchanger and immediately passed through a centrifuge, where the oil and foots are efficiently separated. This method has several advantages, not the least of which is the fact that about one-fourth of the oil which was formerly lost through emulsification with the foots in the batch process is now recovered. Recently, a water-washing and drying system has been added to this method to remove traces of soap and moisture from the refined oil.

Dehydration Developments

Since the beginning of the war, the subject of dehydration has been prominently before the food technologists. Under the pressure of war needs the meat packer technologist was called upon to investigate the various methods used for dehydrating foods and to determine which of these would be most satisfactory for drying meat products. The dryers which have been adopted for drying meat are of the continuous type. Evidence indicates that drying under a high vacuum gives the most satisfactory product, but economy and the availability of equipment were factors in determining the method to use. In most of the methods the meat is first cooked at approximately 165 deg. F. for 30 minutes before going to the dryer. This is to destroy the enzymes and to produce a product with a longer keeping time. Precooking is not used when the meat is dehydrated in the frozen state, but lowering of the moisture content to less than 2 percent is necessary to prevent deterioration. Packaging of dehydrated meat also presented a problem. Technologists found that a hermetically sealed can was satisfactory and that sealing under a vacuum is advantageous.

Freezing and Tenderizing

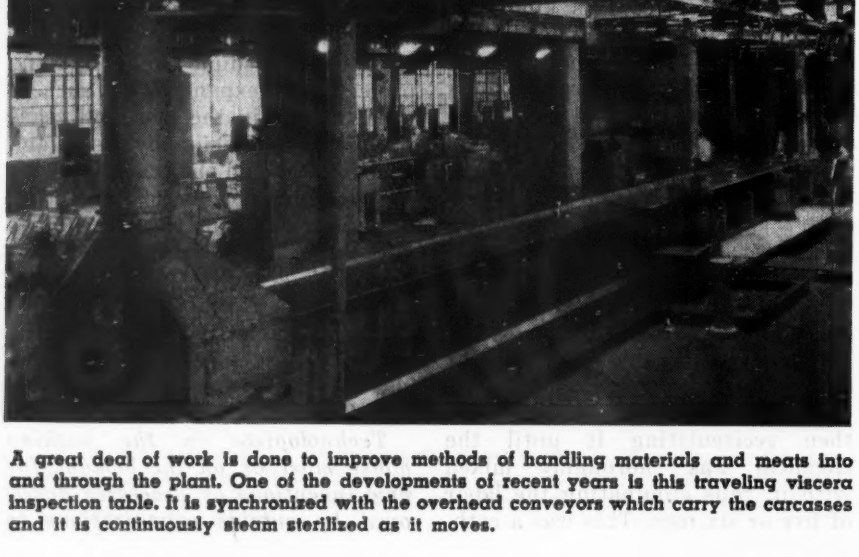
Quick freezing of meats has been studied in the past and is again receiving some attention. More than ten years ago exhaustive experiments were carried on to determine the possibilities of quick frozen meats. Considerable valuable data were obtained on this subject. Meat properly frozen and wrapped to prevent dehydration will undergo little change after months of storage and practically no loss in nutritive qualities. So called "quick freezing," if this is determined by crystal size, can only be applied to thin cuts of meat. Roasts and rounds will be quick frozen on the surface but slow frozen in the interior. Whether quick frozen packaged meats will be acceptable to the consumer is still to be determined. O. G. Hankins states that freezing meat at temperatures below 0 deg. F. has a tenderizing effect. He recommends that, after holding the meat for 15 days at 34 deg. F. to obtain the tenderizing effect of enzymes, it be frozen at a temperature below 0 deg. F. *Quick Frozen Foods,* December, 1944.

This reference to freezing brings up the whole subject of tenderizing. Thus far no satisfactory method other than holding the meat at 34 deg. F. for various lengths of time has been developed. There are on the market some tenderizing solutions made of vegetable enzymes, such as papain, for use by hotels and restaurants. Our experience with these has not been very satisfactory because they impart a foreign flavor to the meat. Also, we are under government supervision and would not be permitted to use products of this kind under present regulations. Sausage casings have been tenderized by means of enzymes, but this has been allowed because the casing is considered a container.

Tricks with Spices

We will mention just one other instance of the adaptation of an outside development to our industry. It is well-known, of course, that the packers are large users of spices of all kinds, particularly in the manufacture of sausage and canned meats. Spices contain much inert material, and if natural spices are used, the flavoring substances must be absorbed by the meat product. In many cases, undesirable small specks, particularly when black pepper is used, can be seen in the finished products. Some years ago a product was developed to replace natural spices by emulsifying the essential oils and oleo resins extracted from them with water. Of course it is understood that the flavor of spices is con-

(*Turn to page* 168)



A great deal of work is done to improve methods of handling materials and meats into and through the plant. One of the developments of recent years is this traveling viscera inspection table. It is synchronized with the overhead conveyors which carry the carcasses and it is continuously steam sterilized as it moves.

EDITORIALS

LAURENCE V. BURTON, Editor

Change in Leadership

THERE is no doubt that President Truman walks a bit farther to the right on domestic issues than did Franklin D. Roosevelt. But no one would call him a reactionary. He will not repudiate Roosevelt policies; but in many cases he is not likely to press them. However, questions as to right and left fade into insignificance, at the moment, alongside the problem of setting up a food administration which will do something to improve the critical food situation. That is the first test of Truman leadership as it affects our particular group of industries. It looks as though he might meet that test.

That the President understands some of the food problems is evident from his record. Consider these comments from the Second Annual Report of his Special Committee Investigating the National Defense Program, March 11, 1943:

"The Department of Agriculture . . . has been slow in formulating basic policies, has lacked vigor and initiative in pushing its program. . . .

"The Committee believes . . . that it (food) must be regarded as necessary to our war effort. For that reason, the Committee is extremely critical of the Office of Civilian Supply in blocking a program for the manufacture of sufficient farm machinery. . . .

"The committee also recommends that every effort be made to assure that tinplate and other supplies are made available to commercial canners for preserving fruits and vegetables and to assure that sugar and other supplies are made available to housewives . . . so as to encourage the greatest possible amount of home canning."

Of long-range significance are comments in an address before the Industrial Conference Council, Sept. 24, 1942.

"I believe in individual initiative. But we all know that individual initiative when unregulated is abused . . . The profit motive . . . is superior to any other system the world has known. . . . But a profit system does lead in some cases to excesses which cause difficulties. . . ."

Likewise significant is a comment before the Chamber of Commerce, Brooklyn, N. Y., on May 22, 1944:

"The present trend requires that thought be given to reestablishing a free and self-sustaining industry. . . ."

In an address before a joint session of the Missouri Legislature on March 21, 1939, he expressed a policy on taxation that may apply in the postwar period. He said:

"I think that the tax burden has to be adjusted in such a way as to give the business man, particularly the little business man, a chance to operate and take up the slack in unemployment."

But in the Third Annual Report of Special Committee Investigating the National Defense Program, on March 4, 1944, remarks were made indicating that a quick postwar reduction in taxes may be opposed:

"If taxpayers are provided with a means of coming out of this war in a financially sound condition, it may not be necessary within the first 18 months after the cessation of hostilities to reduce taxes materially. It may be . . . sounder national economy to keep taxes at a relatively high level now, and for a time after the war."

His recent decision against tax reductions is in line with those remarks.

A key to the President's labor policies may be found in these remarks from the report referred to above:

"Labor has fought a long uphill fight to regain recognition of its rights. These rights must be preserved, and it would be most unfortunate if they should be impaired by imposing upon labor Government restrictions. However, such regulations surely will be imposed upon labor if it fails to recognize and carry out its wartime obligations to the nation."

These comments have been presented for what they meant at the time they were made. It must be recognized that the pressure of events are always the major factor in shaping the course of an Administration.

Obviously, There Is A Job To Be Done

"WHO is chiefly responsible for the fact that the United States is the best fed nation?" The public's answer to that question, as determined by a recent survey, is not what it should have been. Thirty-two percent gave the credit to the government. Only 7 percent said that the food industry was responsible.

"If the food business were run by the government, would you obtain better food for your dollar?" In answer to that one, 30 percent of the food industry's customers said "yes." Only 27 percent believed that they would get "not-so-good" and 29 percent felt there would be little if any difference.

It is regrettable that the achievements of the country's biggest and most essential peacetime industry are so little appreciated. Obviously, the industry has a public relations job ahead of it. What better way to start than by telling the people the facts about the food shortage?

Personal Penalties In W.F.A. Cases

SOME food plant manufacturers are being penalized by large fines for failure to comply with War Food Administration orders. In one case an ice cream plant manager was fined $10,000 for using more milk solids and other materials than permitted under the order governing ice cream making.

Thus the enforcement efforts of W.F.A. become very personal. It is putting legal responsibility right where technical responsibility also rests. Perhaps food technologists are thought by W.F.A. to be more important than they appear to be to some employers. It is nice to be recognized as important, even when the recognition becomes uncomfortable like this.

It is not difficult to see what food technologists have to do about it—just observe the regulations regardless of what the boss would like to have happen.

Safety Pays in Cash

THE Department of Labor conducted a safety drive to reduce accidents in the meat packing industry last year. From July to December "the benefit included savings to the meat industry and workers of $2,456,000." The Department rather effectively argues that the food industries can avoid huge waste from job accidents if they will get busy. The saving here reported was nearly 50 times the expenditure to attain it, certainly a good return on the investment, even ignoring the personal benefit to the individuals protected.

Chemical Residues "Adulterate" Food

RESIDUES of chemicals properly used during food processing may adulterate food under the law even if they are only traces of materials which are not in themselves dangerous to health. This is a basic principle which is now being applied definitely, but cautiously, by the Food and Drug Administration. It is an extension of the principle that toxic insecticide residues remaining in food constitute an illegal hazard.

There have been two recent cases in which this new principle has been at least tentatively applied. In one case F. & D. A. has objected to the canning of peas which had been freed from nightshade berries by oil flotation because there were trace residues of oil in the canned product. Even though the oil might not be dangerous, it would constitute an added unnatural, nondigestible ingredient. Thus the product, under the law as interpreted by F. & D. A., is adulterated.

Proposed use of propionates to reduce rapid spoiling of fruits and vegetables before canning or freezing is causing similar concern. If that chemical is properly used to prevent spoilage it will be subsequently washed off of the foodstuff completely before processing, lest there be illegal traces left in the food. The fact that propionates are not in any way toxic in the quantities remaining does not change this.

All this seems to mean that new developments in food processing must be made with extreme care to avoid chemical residues of nondigestible character. It would seem that the law needs changing to permit a little more generous interpretation, or else F. & D. A. might itself become a little less fussy on nondangerous cases where real value is proven for the chemical treatment. We would prefer to see F. & D. A. a bit more lenient during the time that it takes to have Congress make a suitable minor amendment to the law. There is no need for letting down the bars for dangerous or objectionable residues. But the other extreme of unwarranted fussiness is not good either.

Fire Extinguishers On the Double-Quick

ACTION during the first few seconds of a fire often determines whether it is a blaze or a conflagration. This action usually is the application of a portable fire extinguisher. So it is important that these are placed where they will be instantly available and where access to them is not cut off by fire.

To provide general protection for an area containing normal hazards, one large or two small extinguishers should be within 50 ft. of any point in the area. Fewer are required for light hazards, more for severe ones.

Extinguishers *should* be mounted near a specific hazard, but not so close that they will be involved in case of fire. If the hazard is in a small room, it is good practice to put the extinguishers either just inside or outside the door.

Extinguishers *should* be placed where they can be clearly seen and *their* locations checked once a day. Any obstructions ought to be removed immediately.

In fighting fire, action in time saves many times nine.

Returning Veterans And the Food Business

THE American Legion and the Office of Price Administration are having some difficulty in reconciling their viewpoints as to the proper place for the returning war veterans who want to go into the food business. OPA has taken the position that with the limited supply of foodstuffs it will, in fairness to established concerns, have to apply the same restrictions to veterans as to others in the field. Veterans' organizations take the view that OPA limitations, sharply reducing the amount of material that can be allocated to servicemen wanting to enter the food business, will make it impossible for them to go into the business.

With food as scarce as it is, and with equipment for civilian use unavailable, this would seem to be the wrong time for anyone to set up a new enterprise in this field. This applies to the manufacturing end of the business as well as the distribution end. Besides, it takes know-how in either branch of the business to assure a fair chance of success. In addition, there is a shortage of manpower in all branches of the food industry.

Under the circumstances, government agencies and veteran associations would do well to advise returning servicemen who want to enter the food business to find themselves a job now with an established food company, in either the distribution or the processing end of any of the many branches of the industry. There they would help where help is needed, and at the same time secure the know-how of the business they want to learn.

Everyone would benefit from this procedure. But the one to gain the most will be the veteran himself. By learning the methods and procedures employed by established concerns in the field, he will be much better equipped to go into business for himself when the proper time comes. Experience will have improved his chances for success.

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NEW PACKAGES & PRODUCTS

Sweets for the Boys

CHOCOLATES for the armed forces in the Pacific are going out to post exchanges in brightly lithographed 1-lb. tins of the key-opening type formerly used for vacuum packed coffee. Label designs are very similar to those used by the manufacturers on their domestic packages, so as to carry out the "home" idea, and the assortments look and taste prewar.

Huyler's, Howard Johnson, Wallace & Co. and Stephan Whitman & Sons are participating in the program.

Wallace and Whitman use the familiar brown fluted cups for the individual pieces, with white corrugated glassine between layers and as a liner for the can sides. Howard Johnson is using larger pieces, each in a little cellophane bag sealed at one end and twisted at the other. These are packed with the sealed ends down in the can. All the candy is formulated to withstand elevated temperatures, but in case of excessive exposure, the cellophane-bagged pieces will remain in edible condition.

The Huyler assortment will not be ready for another month or so, since production is waiting on the installation of automatic packing machinery.

Colorful Preserves

ORANGES in paper-thin slices, ground or crushed pineapple and Maraschino cherries, with cane sugar, pectin and citric acid, are

made into a clear golden marmalade by Esper Products de Luxe, of Kissimmee, Fla.

The preserve is offered in 2-lb. jars. The unmarked black metal screw cap has a gold bead on the edge and a plastic-coated paper lining disk.

Ready-to-Bake Cakes

FROZEN bakery products, ready to take home and put in the oven, are finding a ready market wherever they are tried. Stores devoted to a general line of quick frozen foods have found unbaked pie crust and the make-up pies popular. But the Frigid Dough Products Co., in Oak Park, Ill., goes farther and offers rolls, muffins, cookies and cakes, as well as pies. Frostings and fillings are on the list for development as soon as the supply situation permits.

Most of these must be kept in a freezer unit, at low temperatures. The pies can be kept in an ordinary refrigerator for 6 days and cookie dough for a period of weeks.

A sample from each batch is tested for baking properties just before it goes to the consumer, so that the housewife is assured of a successful baking.

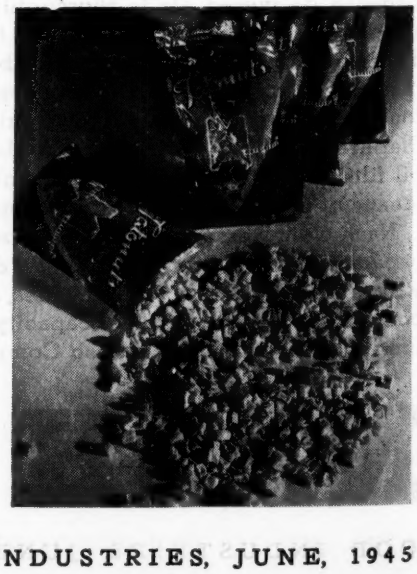
Baking Powder Tins

LAST FALL, Jacques Manufacturing Co., Chicago, put its KC baking powder into glass, up to 5-lb. jars. Recently it has announced a new 10-lb. tin. According to the manufacturer, this does not portend a change back for the entire line. Tin is to be used in this size only, and for the baker's grade of baking powder. If the bakers purchase this large can instead of the 5-lb. jar which they have been using, the latter may be dropped, but the domestic sizes will continue in glass.

The 10-lb. tin has a lithographed label very similar in appearance to that used on the glass jars.

Salty and Crisp

TATONUTS are among the newest of the salty tidbits to nibble with drinks. The potatoes, diced, dried, crisped in oil and salted, are packed in double-walled heat-sealed cellophane envelopes holding 1½ oz. each. The outer envelope is printed in red, blue and white, as is the lightweight boxboard shipping and display carton that holds 24 bags.



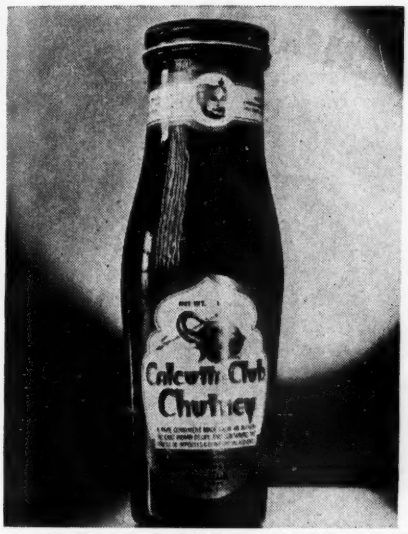
The carton is of patented construction, with a bottom that locks firmly without adhesive, to present smooth and unbroken sides. The top folds back to make a cutout display poster.

Featherweight Foods, Inc., Boston 10, Mass., reports that at present its entire production of this item is going to post exchanges for the use of the armed forces.

From the East

OLD as items in the shops, but relatively new for domestic manufacture, chutney and other condiments continue to hold the attention of specialty manufacturers.

Calcutta Club Chutney, which, according to its label, is made from



an East Indian recipe, contains apples, corn sugar, sirup, onions, raisins, cider vinegar, preserved ginger, candied lemon peel, lime juice, chili peppers, salt and spices. The ingredients are finely divided, so that the sauce is smoother and thinner than many similar products.

Lucullus, New York, emphasizes the oriental background with an elephant head on the four-color oval label and a turbaned "native" on the band at the neck of the tall 1-lb. jar. A metal top-seal screw cap in dark brown with a white bead completes the package.

New Bag

COATED white kraft, lithographed and heat sealed, has replaced the cellophane bag formerly used by E. J. Brach & Son, Chicago, for its pound packages of mixed hard candies and toffee. The new bag has a full-color picture of the candies in their bright individual cellophane wrappers. The background

is sky blue, with darker blue and red in the lettering. The coating maintains the clarity and brilliance of the inks.

Ingredients of the Burgandy Mix include sugar, corn sirup, sweetened condensed skimmed milk, hardened vegetable oils, honey, citric acid, natural and artificial flavors and U. S. certified colors.

Another Ready-to-Use

BARBOUR'S South Pasadena, Calif., has introduced Barbour's Old Fashioned Cocktail Set-up. This attractively colored product consists of orange sections and cherries packed in simple sirup containing Angostura bitters. A trace of benzoate of soda is required.

Against the red and orange of the fruit, a small label in black with a gold background is effective.

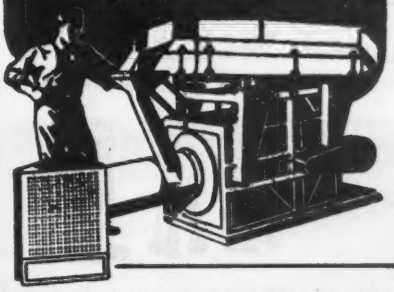
The metal screw cap is without printing, lacquered to match the label background. Jars contain 1-lb. net weight.

No More $TONE$ in Your Bottle-Neck!

• Now, with critical war shortage of labor, streamline STONING in your mill. Removing stones has always been slow, laborious and costly out of proportion to other steps in processing cereals, soy beans, and other dry foods. To eliminate this great headache of the cereal and other dry food processors, we have developed a new type stoner—revolutionary in design, amazing in efficiency, low in first cost, in operation. Removes stones, glass, non-magnetic metals, and all other hard, dangerous contaminations from cereals, soybeans, and other beans, and other food products with, 1) an action so sensitive the tiniest particles are easily removed; and 2) operating cost so low it is relatively insignificant; and 3) 99.9% efficiency. Capacity up to 16 tons per hour.

Write for Bulletin FI-645.

SS&S
AIR-FLOAT
STONER



SUTTON, STEELE & STEELE, INC
DALLAS, TEXAS
In Canada—Kip Kelly, Ltd., 68 Higgins Ave., Winnipeg
Foreign—Separations Engineering, Ltd., 133 Bush House, Aldwych, London

SHE EXPECTS MORE FOODS TO BE VITAMIN ENRICHED

Taste will probably always be the largest single factor in determining the sale of a food. BUT that is no longer the whole story!

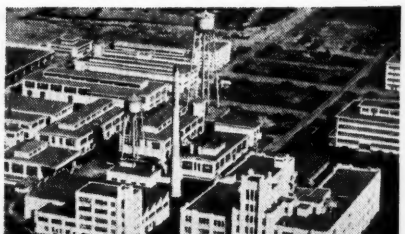
Housewives who have been studying nutrition, and men returning from the Services, have *experienced* the benefits of *improved* nutrition.

They are going to watch the labels for vitamin declarations, to pay particular attention to enriched values.

That is why the end of allocation of most vitamins has witnessed a renewal of the movement, by leaders in the food field, toward restoration and enrichment of certain foods hitherto profitable.

Are *you* sure *your* products will continue to appeal to the public as foods nutritionally well-rounded?

Why not consult our Vitamin Division?



HOFFMANN-LA ROCHE, INC.
Vitamin Division, Nutley 10, N. J.

FOOD INDUSTRY NEWS

GENERAL

Anderson's Appointment Seen As Move to Consolidate Food Control

Former New Mexico representative knows agriculture and the problems that have contributed to the food shortages

THE appointment of Clinton P. Anderson, representative from New Mexico, to be Secretary of Agriculture, and the resignation of War Food Administrator Marvin Jones paved the way for President Truman's indicated plan for a merger of WFA with the Department of Agriculture and the resultant unification of the food program under one head.

When congratulated upon becoming the new food czar, however, Representative Anderson was quick to deny it. "That is not true," he said to a representative of FOOD INDUSTRIES. "Remember that I have been appointed to only one position. However, everyone knows my attitude toward the coordination of the food programs. I stand on the recommendations in the committee report."

The appointment of Mr. Anderson is considered Presidential endorsement of the committee recommendations which are viewed as the new Secretary's statement of policy. If this is the case, it can be assumed that a move will be made to regain much of the Department of Agriculture's power over food programs that was lost under the administration of Secretary Wickard. This would include the recapture of the authority to allocate the food supply among foreign claimants, UNRRA and Lend-Lease, which the President turned over to the interagency committee headed by Leo Crowley. It would also mean that the WFA, as a part of the Department of Agriculture, would set the rationing policies.

The new secretary is a successful farmer, business man and politician. He operates an 800-acre, irrigated farm in New Mexico. He is president of the Mountain States Mutual Casualty Co. of Albuquerque, N. M., and a former president of Rotary International. He was serving his third term in Congress when President Truman elevated him to cabinet rank.

CLINTON P. ANDERSON

Meat and Sugar Short, Many Foods Adequate

ACCORDING to Judge Fred M. Vinson, Director of War Mobilization and Reconversion, the most serious food shortages will be in meat, sugar, butter, and other fats and oils, in that order.

Supplies of cereals, except rice, are adequate. Supplies of fresh and frozen fish are large. Domestic supplies of fresh vegetables are entirely adequate and prospects, based on commercial and victory garden production, are that this situation will continue. The outlook for fresh fruit is that supplies will be almost as large as last year. Civilian supplies of eggs will be about the same as the record totals of last year. Supplies of fluid milk are of record size, and are more than a fourth larger than before the war."

The estimate of the supplies of fruit were made before the mid-May freeze, which did serious damage throughout the northern fruit belts. No true estimate of the frost damage was possible at the time this issue of FOOD INDUSTRIES went to press, but many Department of Agriculture officials were fearful that the loss might approach a national calamity.

Nine Plants Receive New WFA Merit Award

IN recognition of continued outstanding performance in food processing, nine plants have received the War Food Administration's "Star" award. While these plants are the first to be approved for this recognition, performance records of other plants are under review, according to WFA.

All nine plants have previously been awarded WFA's achievement "A" award—which is given on the basis of the plant's meeting high performance records for a period of a year or a processing season. The "Star" is the second-year award. The nine plants have marked up a two-year record of outstanding wartime performance in food processing. They are:

Hanover Canning Co., Hanover, Pa.; Fuhremann Canning Co., Lanark and Sycamore Preserve Works Corp., Sycamore, Ill.; Bercut-Richards Packing Co., Sacramento, Matmore Canning Co., Inc., Woodland, Calif.; Fruitland Canning Ass'n., Fruitland and Idaho Canning Co., Fayette, Idaho; McCormick & Co., Inc., Washburn, Me.; Gerber Products Co., Fremont, Mich.

The following 11 plants are listed to receive "A" awards:

Havranck Bros., Inc., Yonkers, N.Y.; Pet Milk Co., Hudson, Mich.; Midwest Dehydrating Co., Duluth, Minn., Oconomowoc Canning Co., plants at Medford and Stratford, Oconomowoc-Poynette Canning Co., Poynette, Wis.; Chapman Dehydrator Co., Modesto, Tri-Valley Packing Association, plants at Modesto and San Jose, Calif.; Morning Milk Co., Wellsville, Utah; H. & M. Packing Co., Denver, Col.

Warning on Test

AMERICAN INSTITUTE OF BAKING has issued a timely warning regarding careless use of reagents for testing of enriched flour or enriched bread (FOOD INDUSTRIES, May 1945, p. 114). That agency cautions against cyanogen bromide, which is one of these test reagents. Food technologists will want to warn their nontechnical staffs about this, as the hazard is very real.

THE PROCESSING PICTURE

No Immediate Change In Machinery Supply

FOOD-PROCESSING equipment will not be in better supply immediately as a result of the revocation of Order L-292, which controlled production and delivery of food processing machinery. Inquiry as to when replacements may be available in quantity brings various conservative answers. The unofficial view is that for the next few months food processing machinery will be available in about the same quantity as it has been throughout the war, as manufacture never totally ceased. Repairs will be in better supply before complete units are ready, if the economy operates according to present plans.

WPB said that its revocation of this order was in line with the national policy of stepping up the food program. The question of materials and manpower, WPB said, now the chief factors holding up increased production of these items, is being given careful study.

Here is what WPB did to adjust war controls to a one-war basis and make materials more readily available for civilian production:

The Controlled Materials Plan was "open ended," effective July 1. After that date delivery will be permitted, without allotment numbers or symbols, of copper, aluminum and steel that can be delivered without interfering with authorized CMP rated orders.

Orders for this unrestricted material for delivery after July 1 may be placed now.

No hoarding preemptive buying or buying ahead of production needs will be permitted during the early part of the period between the defeat of Germany and the defeat of Japan, John D. Small, Chairman of Period One, announced. In no case, Mr. Small made clear, will WPB's basic provisions prohibiting unreasonable inventories be relaxed until supply and demand are in approximate balance. Checks of inventories will be handled in a manner somewhat similar to CMP inventory audits.

Plants with "open capacity" have been listed so that new work can be guided to facilities most likely to be in a position to handle it. This list will be revised semi-monthly. It will include plants and labor forces made available by contract cutbacks or expiring contracts and will be available in the district offices of the War Production Board. The national "open capacity" list includes all plants with available space of more than 50,000 sq. ft. or 100 workers. It is hoped that it will provide means for speedy placement of war contracts and prevent breaking up of production organizations.

Out of the 420 various limitation and conservation orders in effect April 1, approximately half will be revoked within the next few months. Announcement of the revocation of individual orders will be made from day to day and the effect of the action explained at that time.

Continued shortages of many items were forecast by WPB Chairman Krug which will make retention of controls on those items and materials imperative. All types of containers are in this class. Included among the materials are textiles, tires and rubber products, leather, lumber and forest products, tin, lead, cadmium and other metals. Sheet metal is expected to be in short supply for some time.

PLENTY OF UNRATIONED MEAT

This herd of buffalo is the first to appear on a Michigan range since before the days of Buffalo Bill. They are being raised near Coldwater, for slaughter. With not a red point in the herd, the meat sells for 75 cents to $1.25 per lb. when brought to market.

European Breweries Help Supply Troops

FACED with the problem of supplying huge quantities of beer to meet the growing demand of troops overseas, plus the increased transportation difficulties now being encountered, the Quartermaster Corps has decided that the supply of beer would have to be supplemented from sources other than the United States. J. G. Shakman, vice-president of Pabst Brewing Co., Milwaukee, Wis., spent several weeks in Europe, investigating the possibility of breweries, in reconquered territories, producing American type beer.

Combat forces demonstrated an uncanny accuracy in missing the breweries in the war zones during artillery bombardment. Mr. Shakman, therefore, found them in amazingly good condition. No new machinery will be required to put these breweries into operation for the benefit of our armed forces. Slight modifications of present piping and other brewing equipment will have to be effected, however, to make the equipment more adaptable to American type materials. Adaptation to the method of making the brew also will have to be made.

In about ten of the plants Mr. Shakman visited on the Continent, he found very good modern copper equipment of French and Swiss manufacture. In Italian breweries the equipment was largely of German manufacture. The equipment is of conventional Continental brewing design, but smaller in capacity than commonly used in the United States. Cellar equipment is quite modern, including concrete fermentation tanks, aluminum storage tanks, concrete tanks lined with aluminum slabs and glass-lined steel tanks. Bottling equipment found in these breweries, is the most inefficient part of the plants, and pasteurization units are scarce.

Ingredients from which beer is

"The bigger the family—the better the service"

LUCKY the man who has a big family of kids to wait on him! So is the customer who consults Continental, largest united family in packaging.

We can give you unusual service. The variety of containers we're making now is proof we'll give you the container you need.

Impartial research analyses by experts, and wide facilities assure you we can produce your ideal package. We make metal containers, liquid-tight paper cups and containers, fibre cans and drums, steel pails, and varied heavy duty containers.

Right now we're working hard for Uncle Sam. But keep your eye on Continental! And on Continental's trademark, too! The Triple-C stands for *one* company with *one* policy—to give you only the very best in quality and service.

Tune in: "REPORT TO THE NATION" *every Saturday over coast-to-coast CBS network*

CONTINENTAL CAN COMPANY, INC.

CONTINENTAL PAPER DIVISION

FIBRE DRUMS The Container Co., Van Wert, Ohio

LIQUID-TIGHT FOOD CONTAINERS — Boothby Fibre Can Co., Roxbury, Mass.

PAPER CUPS AND FOOD CONTAINERS — Mono Containers, Newark, N. J.

COMBINATION PAPER AND METAL CONTAINERS

Headquarters: 330 W. 42d St., New York 18, N.Y.

13 Plants — Sales offices in all principal cities

CONTINENTAL PAPER CONTAINERS—Our complete line of attractive paper cups and protective liquid-tight containers has long been widely used by food and meat packers and by dairies everywhere. Especially popular for packing moist foods of all kinds. Space-saving nested cups are available in 4, 6, 8, 12 and 16 oz. capacities, plus Mono Containers in sizes from 1½ oz. up to 10 lb.; liquid-tight containers range from ¼ pint to 10 lb capacity.

LURE THE EYE
to clinch impulse sales

She didn't intend to buy a tooth brush when she went to the druggist's for the baby's soap . . . Smart packaging that lends itself to good display sold her. Likewise, crackers were not on her list when she left home for the grocer's. But that package of fig bars said "Have some" so temptingly that she just couldn't resist.

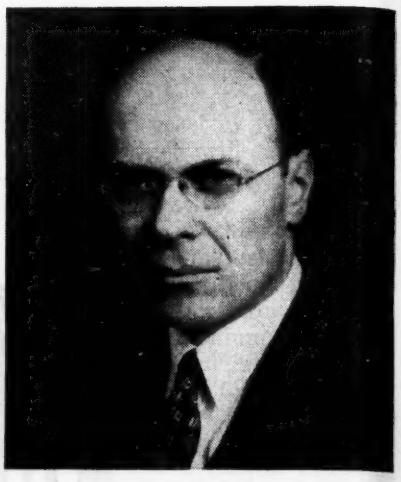
Such impulse purchases make up an important part of most manufacturer's sales – and there is nothing that can promote them more effectively than an eye-catching package.

Sound selling does not end at the point of purchase—neither does good packaging. You will find, therefore, that packages wrapped on our machines also offer the utmost protection to the product—are firmly sealed to shut out dust, moisture and contaminating odors . . . . In short, they have every feature necessary to keep the product in first-class condition from the factory to the home.

Write for our booklet "Sales Winning Packages"

PACKAGE MACHINERY COMPANY
Springfield 7, Massachusetts
30 Church St., New York 7 • 111 W. Washington St., Chicago 2
101 W. Prospect Ave., Cleveland 15 • 443 S. San Pedro St., Los Angeles 13
32 Front St., W., Toronto 1

PACKAGE MACHINERY COMPANY
Over a Quarter Billion Packages per day are wrapped on our Machines



JAMES G. SHAKMAN

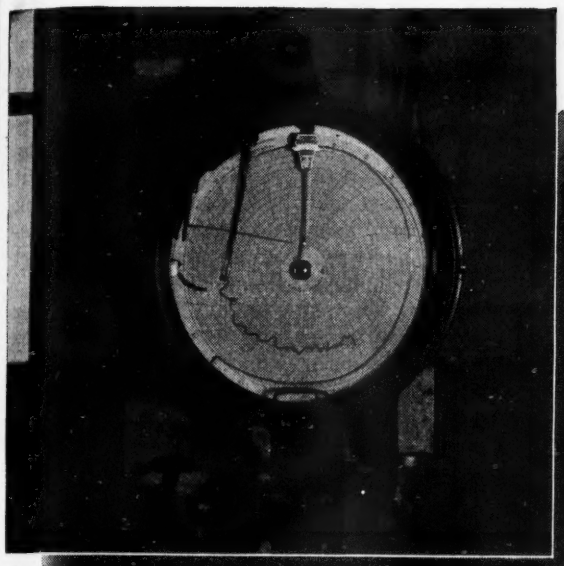
made will be shipped to these reconquered countries and equipment will be converted to the infusion procedure. Beer at 11½ percent extract by weight original gravity, and 3.2 percent alcohol by weight, will be made under these changed conditions.

Shipping space required by 1 cu. ft. of raw materials is the equivalent of 4½ times that much space if it were used in shipping processed beer. The Army wants to supply the soldiers with at least one bottle of beer a day. At least 10,000 bbl. a month would be required to meet this demand.

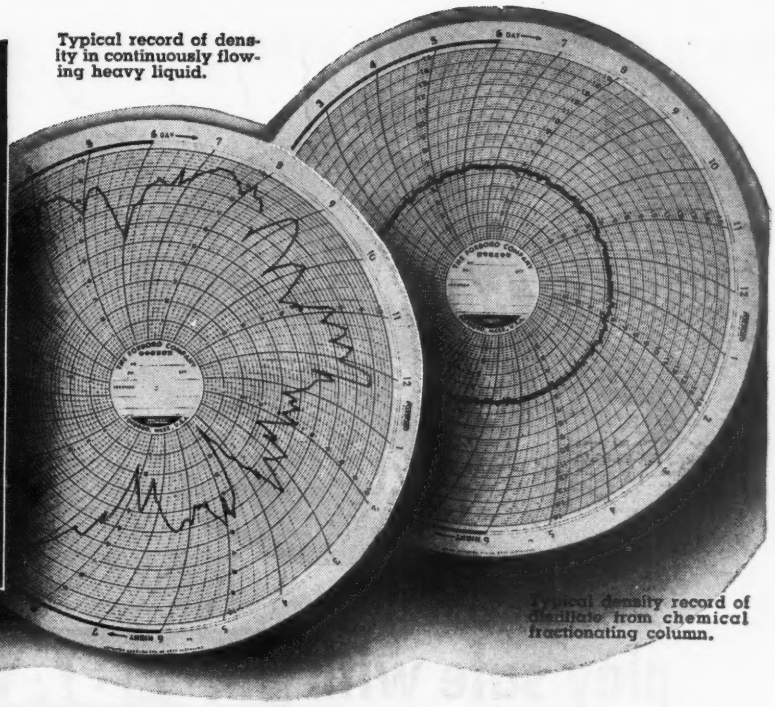
Top Priorities Sought For Food Processors

AIMING to give the food industry a top priority, War Food Administrator Marvin Jones and Rep. Clinton P. Anderson succeeded in having important segments of food processing classified as "critical" in order to qualify them for top consideration in draft deferments and for high priorities on manpower and in the procurement of essential materials and supplies. Manpower priorities are seen as especially important in view of the apparent cutback in war prisoner labor, brought on by the ending of hostilities in Europe. Stringent efforts are being made, however, to increase the number of these prisoners to be made available to processing plants during the season's peak.

With the same end in view, the War Production Board told the Beverage Machinery and Equipment Industry Advisory Board that permitted production in the third quarter had been increased from 25 to 50 percent of their average annual production for the base years 1939, 1940 and 1941. WPB also revoked L-126, which set forth speci-

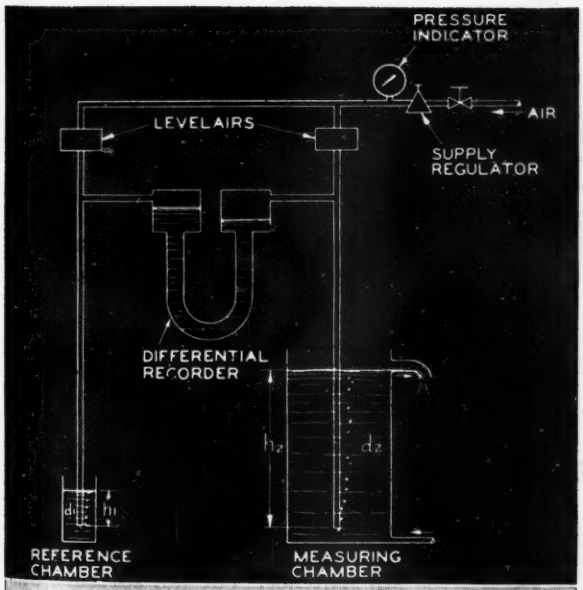


Typical record of density in continuously flowing heavy liquid.



Typical density record of distillate from chemical fractionating column.

NOW...Continuous Records of Liquid Density, *Automatically!*



HOW IT WORKS This diagram shows the operating principle of the Foxboro Density Recorder. The head (density x height) of a variable-density liquid is compared with the constant head of a constant-density reference liquid by the air-bubble method of head measurement. Reference chamber contains constant-density liquid. The variable-density liquid flows continuously through the measuring chamber at constant depth. The Foxboro Density Recorder accurately measures and records the differential pressures.

There are no gaps in your density records for flowing liquids . . . and no possibility of errors due to misreading of a bobbing glass hydrometer . . . when you put a Foxboro Liquid Density Recorder on the job!

This automatic hydrometer is a permanent installation that accurately measures density at every instant and continuously records it. The instrument can be located anywhere up to 1000 ft. from the measuring point. Without attention from the operator, it gives a complete, graphic check on density, even in heavy fluids. Open records permit easy reading to small unit values. May be calibrated in specific gravity, density or other scales.

Foxboro Density Recorders are now used for many food plant liquids including water-molasses mix, brine, alcohol, coffee concentrate, fruit juice. For many processes, automatic Foxboro Density Controllers also are available.

Write for detailed Bulletin A-264 on these important production aids. **The Foxboro Company, 30 Neponset Avenue, Foxboro, Mass., U. S. A.**

RECORDING · CONTROLLING · INDICATING

FOXBORO Instruments

hot weather breeds extra hazards—

play safe with LO-BAX*

Even the most modern food and beverage plants must exercise extra precautions to maintain quality control during the hot months. The most remote possibility of contamination must be avoided to safeguard foodstuffs and equipment.

Lo-Bax*, the concentrated, fast-killing chlorine bactericide, helps prevent food spoilage, improves quality standards by rigidly controlling bacteria, keeping down mold and sanitizing all surfaces with which food or beverages come in contact.

Simple and easy to handle—Lo-Bax kills bacteria almost instantly on contact . . . and at amazingly low cost. Dissolves quickly in water—hot or cold, hard or soft—to make clear chlorine-rinse solutions. Containing 50% available chlorine, Lo-Bax is dependable — retains its strength.

Protect your production this vital summer—with Lo-Bax. Further helpful information will be sent upon request.

THE MATHIESON ALKALI WORKS (INC.)
60 East 42nd Street, New York 17, N. Y.

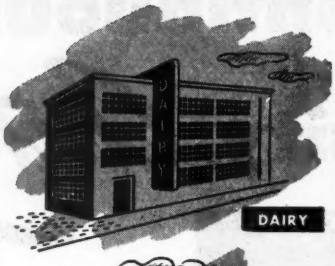
*LO-BAX
50% AVAILABLE CHLORINE

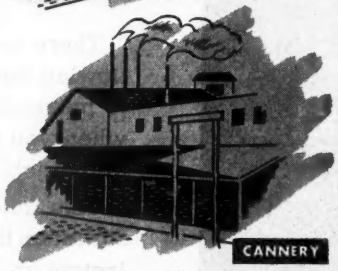
LO-BAX SPECIAL — a superior chlorine bactericide in granular form — packed in 2½-lb. bottles, ½ doz. to the case; and in 14-oz. bottles, 1 doz. to the case.

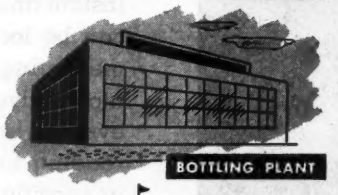
LO-BAX POWDER — a highly efficient chlorine bactericide packed in 28-oz. bottles, 1 doz. to the case.

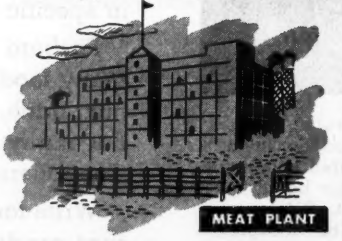
Mathieson
LO-BAX
CHLORINE BACTERICIDE

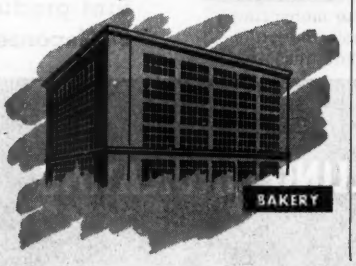
Lo-Bax • Super-Nufos • HTH-15 • Dry Ice • Carbonic Gas • Ammonia, Anhydrous & Aqua • Caustic Soda • Soda Ash • Bicarbonate of Soda • Liquid Chlorine • Chlorine Dioxide • PH-Plus • Synthetic Salt Cake • Sodium Chlorite Products • Sodium Methylate











fications and schedules for specified items of industrial and commercial refrigeration and air-conditioning equipment and machinery. WPB warned that the revocation covers only the restrictions imposed by this order and emphasized that it must not be considered as giving any assurance that all the materials required to make the product will be available.

The same agency has placed fiber containers and drums, steel drums and pails and wooden boxes and kegs on the National Production Urgency list.

Plan Research Program For Frozen Food Items

THE Frozen Food Foundation, Inc., has established a new headquarters in Syracuse, N. Y., where it will carry on its work in technical research. The organization, formerly operating as the Frozen Food Institute, is being sponsored by a number of the country's leading department stores, including R. H. Macy and Marshall Field & Co.

According to present plans, the technical staff, now being formed by Director Gerald A. Fitzgerald, will work primarily in testing frozen cooked products, testing consumer reaction to certain types of frozen foods and development of quality control standards.

The staff members include Dr. Donald K. Tressler, consulting food technologist, Dr. Jean L. Simpson and Dr. Jennie McIntosh.

Overquota Milk Solids Bring Stiff Penalties

PENALTIES for the illegal use of milk solids in the manufacture of ice cream mix are severe.

The latest action to be taken by WFA against violators of this order resulted in a fine of $10,000 being imposed upon a Somerville, Mass., creamery. The general manager of the company also was fined $10,000 and given a three months' jail sentence. The jail sentence was suspended and he was placed on probation for one year, the probation being conditioned upon payment of $1,000 monthly toward the fine. Both the company and the general manager pleaded guilty to the illegal use of milk solids in the manufacture of ice cream mix, which the company distributed to various ice cream manufacturers. The defendants in this case had exceeded their quota by over 63 percent and had created a situation resulting in violations of the order by their customers.

IN THE BYRON JACKSON PNEUMATIC SPONGE

THE SIMPLE "CIRCLE S" RUNNER REDUCES WEAR— PREVENTS CLOGGING

Here's how

Point of greatest wear in any sump or sponge pump is in the runner and when pump chokes up the trouble is usually traceable to the same source. Constant replacements due to wear, as well as down time to clean pump, are materially reduced by incorporating the "Circle S" runner in the Byron Jackson Pneumatic Sponge.

This two port impeller design, first of all, permits the easy passage through the pump, to the discharge port, of any spherical solid able to enter the eye or suction intake of the pump. Second, the curved vanes of the runner are so designed that sand, gravel and other abrasives, carried in suspension in the pumped fluid, do not directly impinge upon any one section of the runner, or pump case. Instead, easy, natural flow lines are followed from entrance to discharge ports, thereby minimizing possible wear.

Rugged, compact, yet light in weight (85 pounds), the Byron Jackson Pneumatic Sponge is suitable for operation in any position. Designed for pumping heads up to 150' in single stage and 300' in two stages, solids 9/16" in diameter may be handled in the 2-1/2" size and 1-1/8" through the 3" size. The Rotary air motor operates on compressed air at pressures from 70 to 100 psi. Write today for Pneumatic Sponge Bulletin.

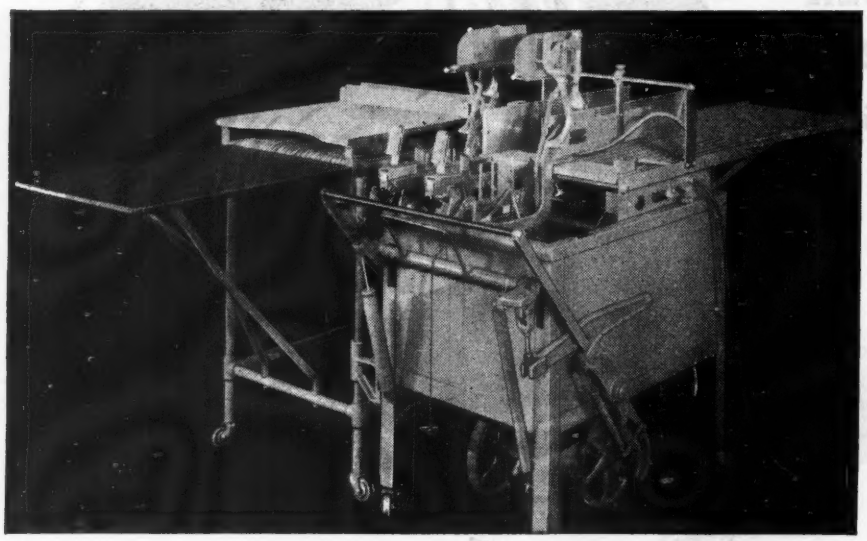
ARMY E NAVY

BYRON JACKSON CO.

Houston • LOS ANGELES • New York

Miller

MODEL M P S WRAPPING MACHINE



SPEEDILY and economically wraps packages in many sizes. Cuts its own wrappers from cellophane or paper rolls. No tools needed to adjust. One girl is all you need to operate or adjust either the heat-sealing or glue-sealing models. Mounted on casters, the MILLER Model MPS can be rolled to the job. Plugs into any wall outlet for power. Send us samples of your packages. We'll quickly give you complete information on this versatile, dependable wrapping machine.

CORLEY-MILLER MODEL BJ VERTICAL HOT PLATE

Heat seals bags, cartons or other packages in MST cellophane, waxed, or thermoplastic coated papers. Ideal for trays or window boxes. Non-corrosive stainless steel and aluminum construction makes it perfect for use in quick freeze plants, locker plants and other damp locations.

MACHINES FOR: WRAPPING, BAG MAKING, BAG AND CARTON FILLING, BAG CRIMPING OR CLOSING, GLUING AND SHEETING, SANDWICH MAKING.

Miller Wrapping & Sealing Machine Co.

12 SOUTH CLINTON STREET, CHICAGO, 6, ILLINOIS

The policy of the Compliance Division of WFA parallels that of the War Production Board. (FOOD INDUSTRIES, April, 1945, page 114.) The endeavor is simply to keep industry operating within the terms of the government regulations. There is no indication that the fall of Germany is to bring any relaxation either in the food orders or the vigorous efforts to secure compliance. In fact, bakers and grocers have been warned of continued prosecutions under WFO 1, which forbids consignment selling of baked goods. In an official WFA statement, concurred in by the Department of Justice, it is explained that violators of the order will be promptly brought into court and prosecuted.

DISTRIBUTION

Vast Fishing Rights Denied Alaska Indians

Aboriginal claims of Alaska Indians, who sought to set aside vast portions of southeastern Alaska with its fishing rights for their exclusive use, recently were held invalid by Examiner Richard H. Hanna.

Reporting to Secretary of the Interior Harold L. Ickes, Judge Hanna, formerly of the New Mexico Supreme Court, declared that the Indians failed to establish their exclusive rights to tidal waters for fishing or exclusive possession of definable territory.

Granting of the claims would virtually have killed Alaska's multi-million dollar salmon canning industry.

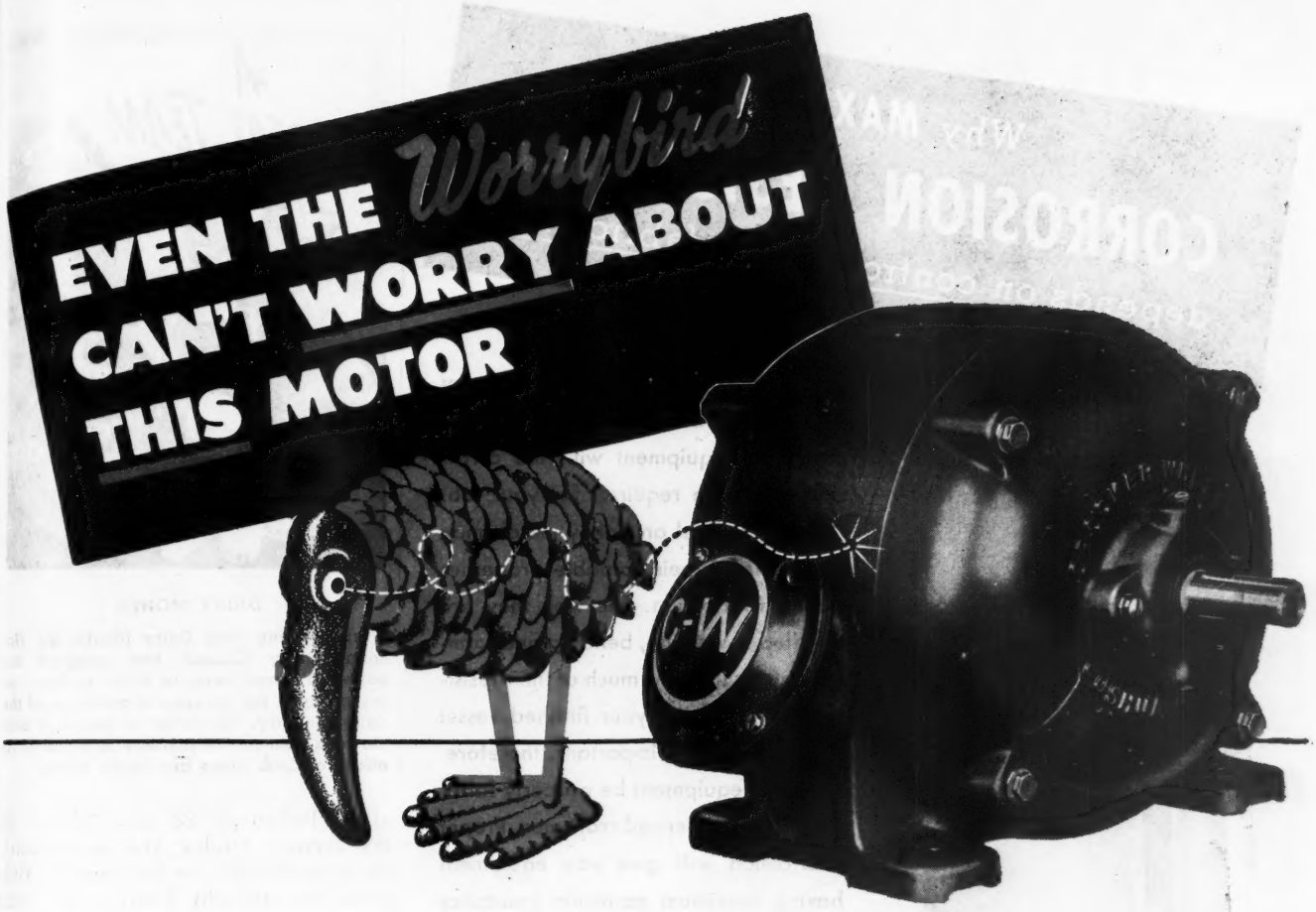
More Lend-Lease Food Shipped to Belgium

The United States has sent approximately 46,500 long tons of Lend-Lease food and medicines valued at $12,500,000 to Belgium in recent weeks to help increase her production of war materials.

Included in the cargoes that reached Belgium were: rye, 14,000 tons; cattle feed, 8,600 tons; soybeans, 6,500 tons; dried peas, 3,400 tons; dried eggs, 3,000 tons; seeds, 2,300 tons; fatbacks (dry salt meat), 2,300 tons; lard, 2,000 tons; condensed milk, 1,200 tons; raisins, 1,000 tons; penicillin, 1,150 pounds.

These cargoes were sent under the terms of a Lend-Lease agreement that the United States and Belgian governments signed on April 17, 1945. Shipments moving

EVEN THE *Worrybird* CAN'T WORRY ABOUT THIS MOTOR



Can't worry about premature breakdown.

The Crocker-Wheeler Protected-Type Motor is built to last. Frame and shields have no openings above the horizontal center line, which means that dripping liquid and falling metal chips won't get in to damage the interior working parts. Vinylastic insulation makes coils dirt, oil, and moisture resistant to a high degree. Phase insulation provides added protection. Dynamically balanced, ALUCAST rotor is practically indestructible.

Can't worry about maintenance.

Patented bearing seal for ball bearings (sleeve bearings are optional) is so effective that re-greasing is required only once a year or even less frequently. This seal permits use of softer grease for better lubrication and longer bearing life.

Can't worry about first cost.

Despite all these advantages, Protected-Type Motors cost no more than conventional open types. They combine added protection with the surplus capacity (40C rise with a 15% service factor) of the open motor.

Why not investigate the many advantages of this new motor—to see if you can't end your own worries? Send for your FREE copy of descriptive bulletin, DL-121, that shows how these motors are protected, where they should be used, why they will give long trouble-free service. Write today—no obligation.

CW-1

CROCKER-WHEELER

A DIVISION OF JOSHUA HENDY IRON WORKS, AMPERE, NEW JERSEY

Branch Offices: BOSTON • BUFFALO • CHICAGO • CINCINNATI • CLEVELAND • DETROIT • LOS ANGELES • NEW YORK • PHILADELPHIA • PITTSBURGH • SAN FRANCISCO • WASHINGTON

SQUIRREL CAGE MOTORS WOUND ROTOR MOTORS DIRECT CURRENT MOTORS GENERATORS FLEXIBLE COUPLINGS

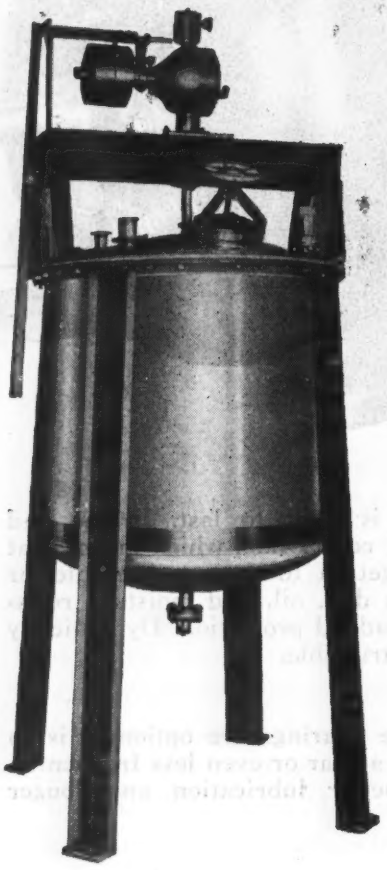
Why MAXIMUM
CORROSION RESISTANCE
depends on control during fabrication

It requires more than mere accuracy in following blueprints to build your processing equipment with the corrosion resistance required for your job.

Stainless steel and alloy metals may lose some of their valuable properties during fabrication. The way they are handled in welding, bending and forming determines how much of their resistance to corrosion your finished vessel will possess. It is important, therefore, that your equipment be properly fabricated by experienced craftsmen. Proper fabrication will give you equipment having maximum corrosion resistance and, consequently, longer service life.

S. Blickman, Inc. has specialized in the fabrication of corrosion resistant metals for many years. Our shop procedures are constantly checked and carefully controlled to guard the properties required in your vessel. When you turn your job over to us, you can be sure of equipment with maximum service life and lower maintenance costs. Consult with us on your next job.

S. BLICKMAN, INC.
4106 GREGORY AVENUE
WEEHAWKEN, N. J.

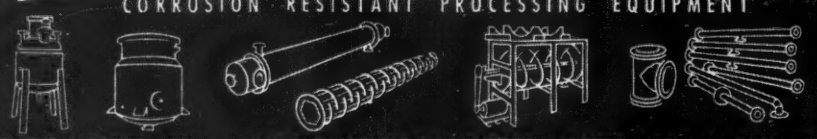


Stainless steel coil heated mixing kettle. One of a wide variety of stainless steel and alloy vessels manufactured by S. Blickman, Inc. to withstand severe operating conditions in the processing industries. Plate 7017

S. BLICKMAN, INC.
Guards Alloys in Fabrication

A request on your letterhead will bring our guide, "What to Look For When You Specify Stainless Steel for Your Processing Equipment."

CORROSION RESISTANT PROCESSING EQUIPMENT



TANKS • KETTLES • STILLS • HEAT EXCHANGERS • AGITATORS • MIXERS • TOWERS • PIPING

DAIRY MONTH

In spotlighting June Dairy Month, the National Dairy Council has adopted the poster, pictured here, in order to focus attention upon the manpower problems of the dairy industry. The father is proud of both his sons, just as the industry is proud of its efforts on both home and battle fronts.

since February 28 are subject to its terms. Under the agreement, these materials are provided to Belgium as straight Lend-Lease until such time as their war use is declared ended. After that time, such shipments as are made to Belgium under the agreement will be paid for by Belgium in dollars on terms provided in the agreement.

Belgium's contributions of reverse Lend-Lease materials to the United States armed forces far surpass in quantity and dollar value the direct Lend-Lease aid that we have given her. A United States Army estimate places the value of this reverse Lend-Lease aid at about $48,000,000 through February 28, 1945.

Canners' Tin Supply Shows No Improvement

V-E DAY has come and gone and no improvement in the tin can supply is in sight. Can manufacturers have been told that third-quarter allocations of metal probably will be adequate only for the needs of the military. The immediate difficulty is the shortage of steel strip. The long term trouble is the supply of tin. It is officially stated that unless substantial cutbacks not now apparent in military requirements should develop, there will be neither material or facilities to make cans for additional products for domestic civilian use.

With military needs for tin cans rising rather than decreasing, the

To meet the needs for safe shipment and storage of war supplies, many new packaging materials and methods have been developed. Outstanding among these is the water-vapor-proof package capable of protecting fruits and vegetables from evaporation of natural juices over a period of many months. Shellmar has pioneered in the development of this and other outstanding war packages. Today Shellmar is already working with many companies in planning postwar applications of these packages. If you have a problem of protecting freshness, taste and color, contact Shellmar now.

SHELLMAR Products Co.

MT. VERNON, OHIO

Chicago • New York • Pasadena

CONVERTERS OF CELLOPHANE, PLIOFILM, CELLULOSE ACETATE, SARAN, FOILS, PAPERS, GLASSINE, LACQUER COATINGS, VINYLS

A CONVEYOR-COORDINATED PLANT that you can be proud of!

ARE you satisfied with your present production plant? Does material or goods in process flow smoothly with the least disorder, loss of time, waste of space or man-power?

If there is room for improvement, isn't it a matter of better coordination—better linking of all the steps involved from receiving — to shipping?

Whether your rate of manufacture is several hundreds a minute or one an hour, Standard builds conveying equipment to meet the situation.

The range and versatility of Standard Conveyor equipment are the result of nearly 40 years of close contact with inside-the-plant transportation — in plants large and small, making products as widely diverse as steel or cosmetics. The benefit of this experience is available to you, without obligations. The counsel of Standard Conveyor engineers is valuable in deciding on the right kind of conveying equipment to coordinate operations faster — for lower cost.

Write for comprehensive reference book —"Conveyors by Standard"— Catalog No. F1-65

STANDARD CONVEYOR CO.

General Offices: North St. Paul 9, Minn.

Sales and Service in Principal Cities

declining tin stockpile has become a matter of official concern. Food processors have been warned that the situation cannot improve for two years or more after the Far Eastern sources have been freed from Japanese control. The only source of tin which is capable of expansion during the present crisis is the salvage tin container. Yet in the face of this situation Conservation and Salvage Division officials state that detinning plants are operating at only 50 percent of capacity through lack of material.

"Our 70,000 ton tin stockpile is in danger of complete exhaustion if consumption continues at present rates," said Erwin Vogelsang, director of the WPB Tin-Lead-Zinc Division, in a recent review of the situation. "As a matter of selfish interest, food processors should endeavor to increase the salvage of used tin cans."

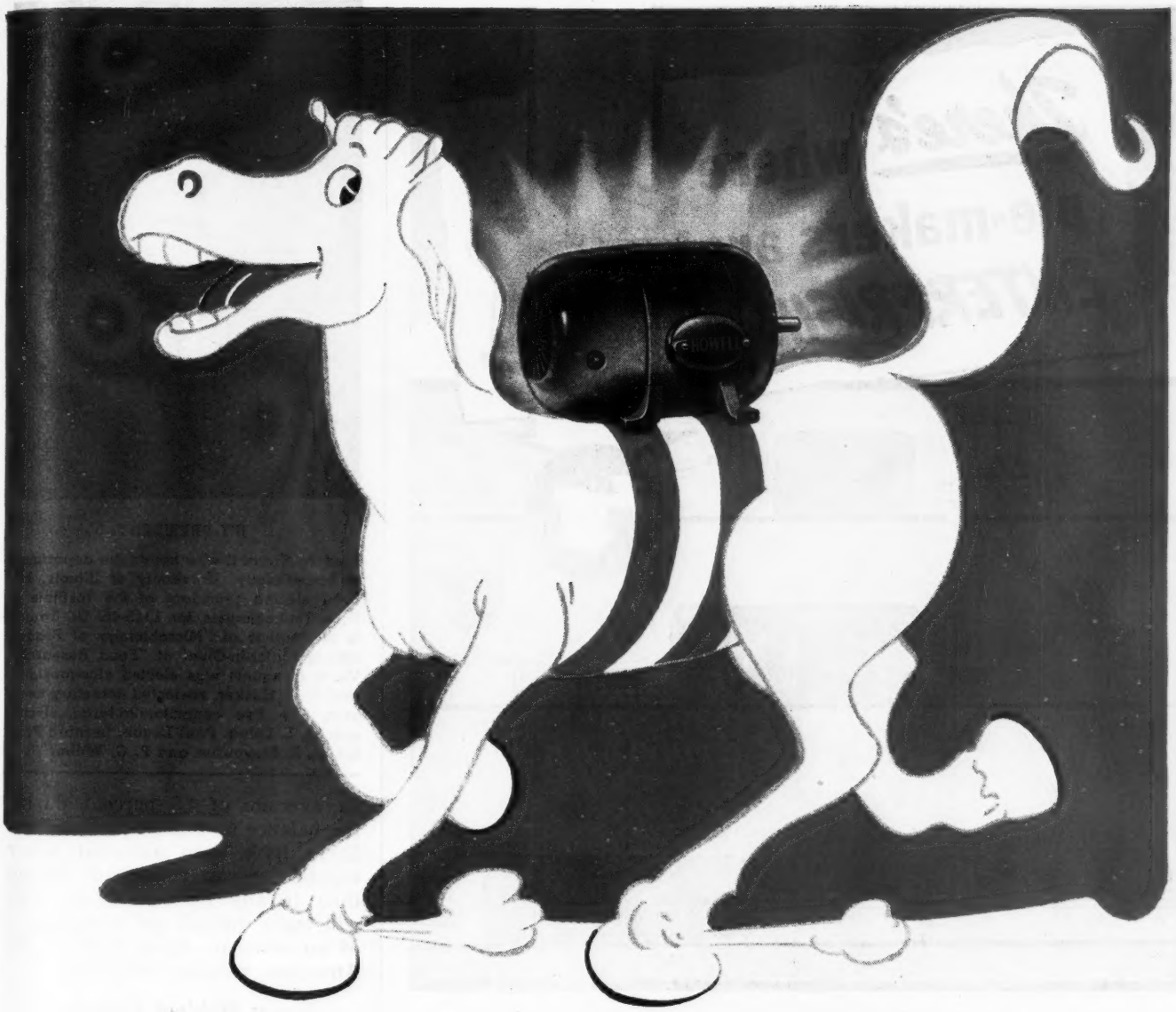
Sugar Shortage Blamed On Agency Management

THE House committee investigating food shortages concluded its hearings on sugar last month, after taking evidence indicating that the general failure of the responsible Government agencies to plan an adequate sugar supply is largely responsible for the present sugar famine.

At the same time, a Republican Congressional Food Study Committee made public a report placing responsibility for the sugar situation on the Commodity Credit Corp. and the OPA, because of the CCC's failure to use the authority given it by Congress to encourage production in Puerto Rico and Cuba, where 60 percent of our sugar supply is grown, and because OPA failed to properly regulate rationing of sugar. The committee's charges reiterated, for the most part, those made in the so-called "Bunker report" published two years ago but never released. (FOOD INDUSTRIES, July, 1944, p. 108.)

Manual E. Rionda, official of several Cuban raw sugar producing firms, testified that the United States was adamant in imposing restrictions on Cuban production. He said that, because of this policy, only 25 percent of the amount intended was spent for sugar plantings in 1943.

Ellsworth Bunker, president of the National Sugar Refining Co., and author of the Bunker report, said that while domestic sugar refining operations will be reduced on



It may come to this—
but we won't cut Howell Quality

The Howell Protected Type Motor, shown, gives complete protection against dripping liquids, metal chips and other falling particles. Completely streamlined—utilizing non-breakable steel frame—malleable or steel base—cast iron end plates and cast iron, weatherproof terminal box are standard construction features. Special horizontal and vertical mountings are available.

Available in sizes 5 H.P. and smaller. Other sizes and types available up to 150 H.P.

Yes, it may even come to the point where we have to press the good old Howell Horse into service to make deliveries on our famous motors. That's how serious the delivery situation is in the entire electric motor industry today.

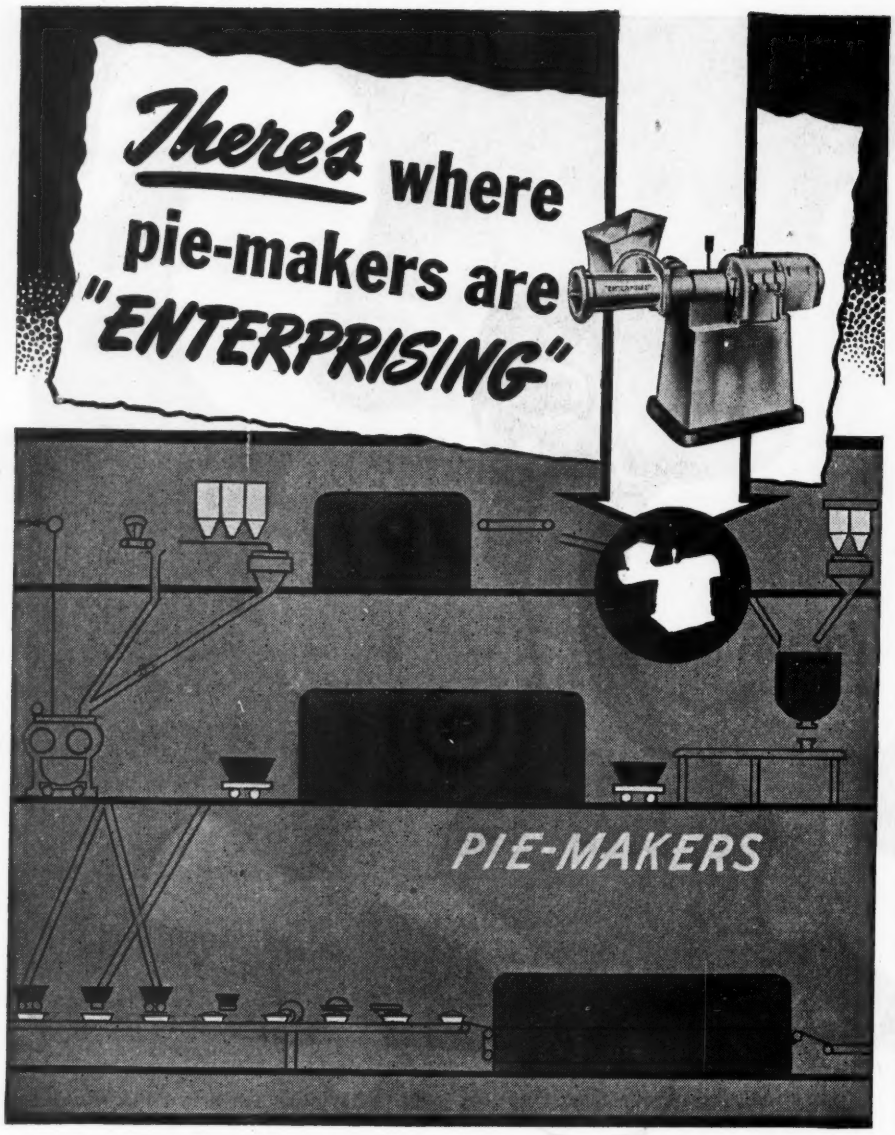
But there's one thing you can count on now, as always—*we'll never, never cut Howell quality.* Every Howell Motor is built of the finest material, statically and dynamically balanced, and thoroughly insulated throughout.

So, until the delivery situation clears up, please bear with us. We recognize our obligations fully. We are putting forth our maximum efforts to build more and more Howell Motors, and to see that they are distributed among users whose needs are most vital to the war effort. This, we know, is as you would have it.

HOWELL ELECTRIC MOTORS COMPANY

HOWELL, MICHIGAN

Manufacturers of Quality Motors Since 1915



A LOT of bakeries solve their cutting problem with an Enterprise Chopper. Thanks to the exclusive Enterprise System of Cutting, food is cut, not mashed; and is sped on to the next operation, flavor and texture intact. Packers, too, and canners, confectioners—food-processors of all types—get a better product at a lower cost with an Enterprise.

Enterprise experts have been solving food-reduction problems for 79 years. Maybe we could help on yours; we'd certainly be glad to try.

The ENTERPRISE System of Cutting

It's exclusive! It's superior!

The ENTERPRISE MFG. CO. of PA.

PHILADELPHIA 33, PA.

79 YEARS' EXPERIENCE BEHIND THE MODERN "ENTERPRISE"

IFT PRESIDENT

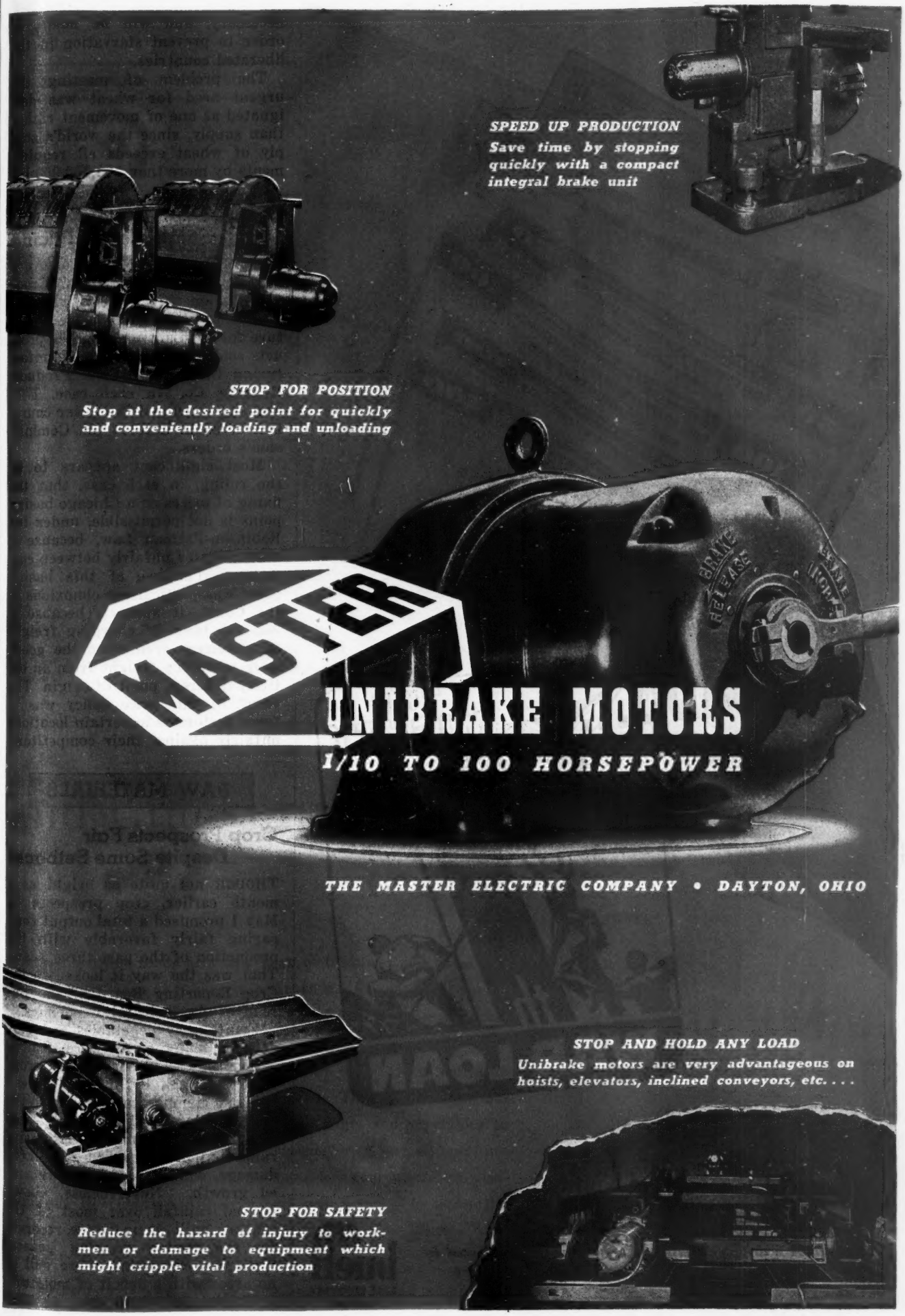
Fred W. Tanner, who heads the department of bacteriology, University of Illinois, has been elected president of the Institute of Food Technologists, for 1945-46. Dr. Tanner is the author of "Microbiology of Foods," and is Editor-in-Chief of "Food Research." Victor Conquest was elected vice-president and G. J. Hucker, reelected secretary-treasurer. The five councilors-at-large elected are: M. L. Laing, Paul Logue, Bernard Proctor, A. E. Stevenson and P. C. Wilbur.

an average of 25 percent during the balance of this year, Cuban refiners have been assigned larger supplies of raw sugar for refining than in any previous year. This will make difficult the maintenance of an adequate labor force in the American refining industry.

Sugar Problem Presented

John T. McCarthy, president of the American Bakers Association, contended that adequate quantities of sugar must be made available to the baking industry to assure maximum use of the one food item in plentiful supply, cereals. His views were supported by Frank G. Jungwaelter, executive secretary of the Associated Retail Bakers of America, who said that the industry is currently producing 145 percent of the quantity of bakery products it produced in 1941, with only 75 percent of the sugar it used in that year.

H. R. Chapman, chairman of the National Confectioners Association sugar committee, suggested that sugar program be placed under the control of one man, that a constant review be made of allocations of sugar to foreign claimants, that it be determined if seed has been properly allocated to foreign nations, that the question of substitute sirups for allocation to foreign claimants be investigated, that the


SPEED UP PRODUCTION
Save time by stopping quickly with a compact integral brake unit
STOP FOR POSITION
Stop at the desired point for quickly and conveniently loading and unloading
MASTER
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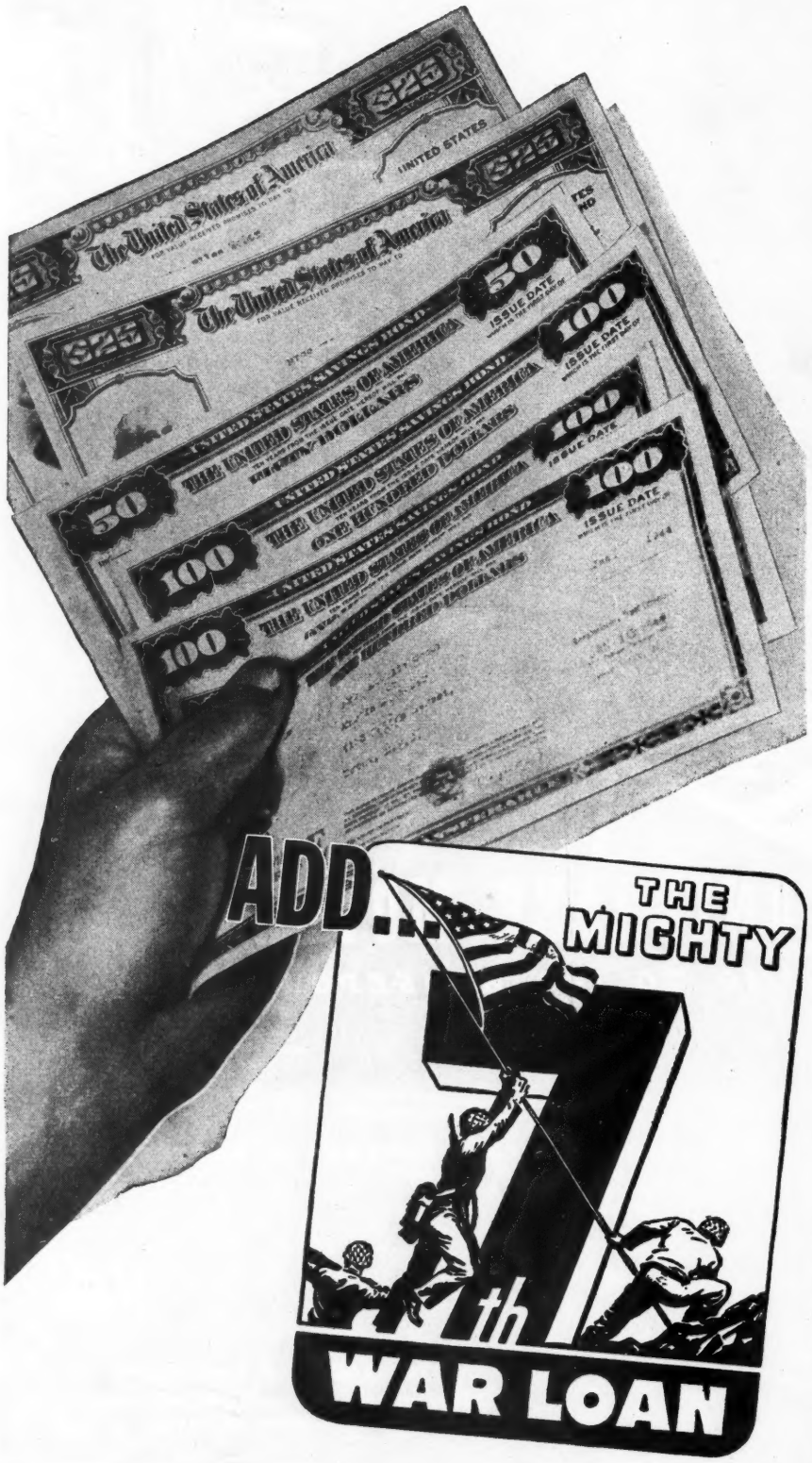
1/10 TO 100 HORSEPOWER
THE MASTER ELECTRIC COMPANY • DAYTON, OHIO
STOP AND HOLD ANY LOAD
Unibrake motors are very advantageous on hoists, elevators, inclined conveyors, etc. . . .
STOP FOR SAFETY
Reduce the hazard of injury to workmen or damage to equipment which might cripple vital production



A War Bond Message Designed and Contributed by Buell Engineering Company, Inc., New York

buell
DUST RECOVERY SYSTEMS

necessary, and will be made, in order to prevent starvation in the liberated countries.

The problem of meeting the urgent need for wheat was designated as one of movement rather than supply, since the world's supply of wheat exceeds all requirements by more than 300,000,000 bu.

Basing Point System Eliminated in Pricing

SUPREME COURT decisions, on April 23, supported the Federal Trade Commission in two cases where it sought to change the price structure for corn sirup and other products sold by A. E. Staley Manufacturing Co. and by Corn Products Refining Co. In each case, FTC was sustained and the lower courts instructed to enforce the Commission's orders.

Most significant appears to be the ruling, in each case, that the fixing of prices on a Chicago basing point is not permissible, under the Robinson-Patman Law, because it discriminates unfairly between customers. The use of this basing point was particularly obnoxious to the Court, it appears, because it was the basis of charging freight to customers even when the goods were moved by freight from an entirely different point of origin. The result of this price policy was to favor customers in certain locations unfairly against their competitors.

RAW MATERIALS

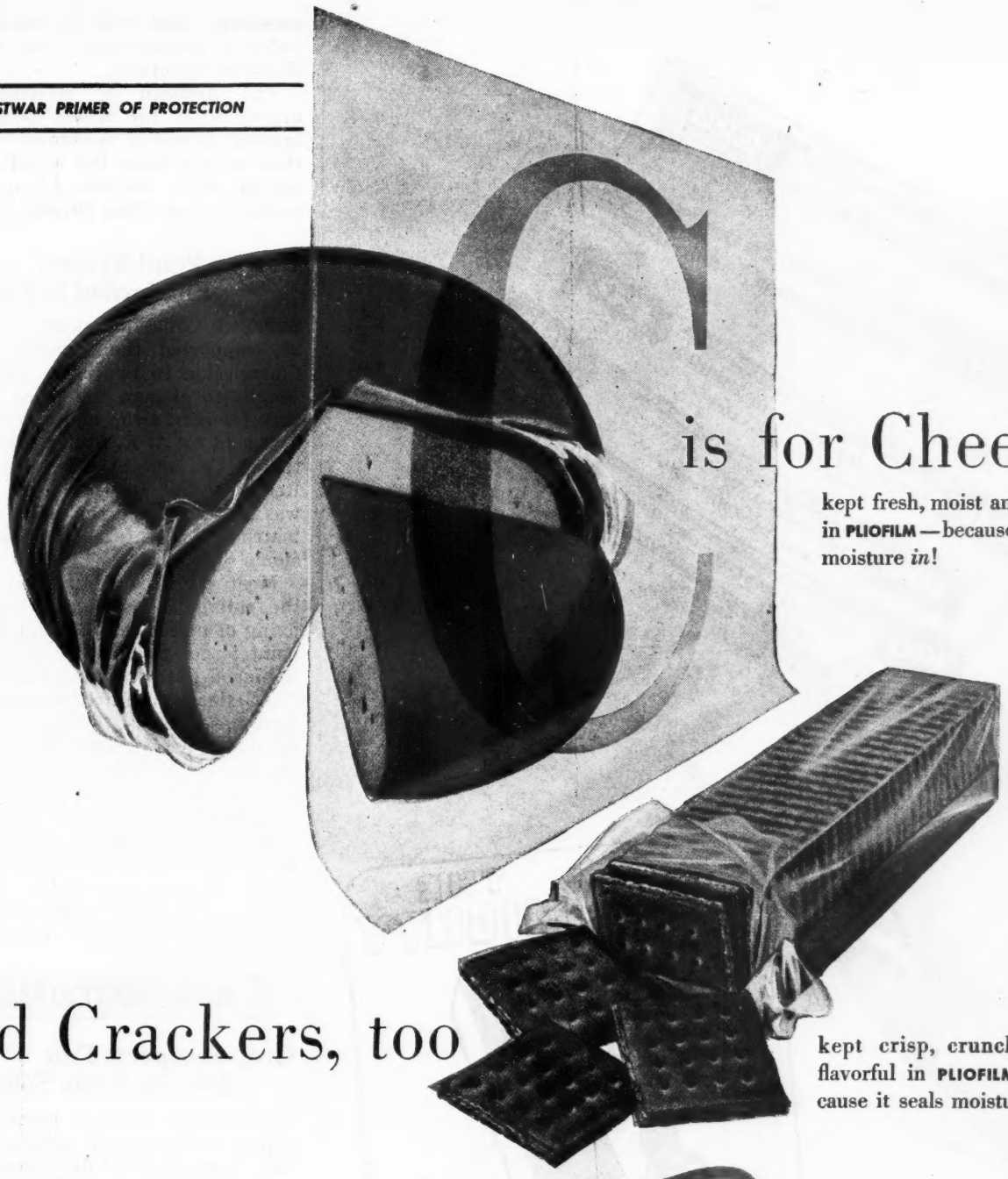
Crop Prospects Fair Despite Some Setbacks

THOUGH not quite as bright as a month earlier, crop prospects on May 1 promised a total output comparing fairly favorably with the production of the past three years. That was the way it looked to the Crop Reporting Board of the Bureau of Agricultural Economics.

Fruit, early vegetables and gardens in many areas were dealt a severe blow, and some other crops were set back by the widespread freezing temperatures during the first week of April and by repeated frosts during the month. Excessive rains and floods caused some crop damage, while cool weather retarded growth. Nevertheless, above-normal rainfall over most of the country built up moisture reserves for the coming growing season. With few exceptions, there will be no areas with a deficit of moisture.

The winter wheat crop, at 835,-

POSTWAR PRIMER OF PROTECTION



C is for Cheese

kept fresh, moist and tangy in **PLIOFILM**—because it seals moisture *in*!

and Crackers, too

kept crisp, crunchy and flavorful in **PLIOFILM**—because it seals moisture *out*!

You'll sell fine foods at a new peak of freshness and flavor just as soon as they can be packaged in **PLIOFILM**—for a double-barreled reason. ★ This transparent, air-vapor-proof wrapping has no equal for keeping moisture where it belongs—*inside* or *out*! ★ Best proof of that is the fact **PLIOFILM** has measured up to the job of moisture-protecting American warplane engines. ★ That is why none has been available for bringing harvest-ripe fruits and vegetables to American tables; for safeguarding tobaccos, drugs and all moisture-sensitive products ★ But alert merchandisers everywhere are planning now to **PLIOFILM**-seal their wares, come peace—to assure the finest quality ever known. Chemical Products Division, Pliofilm Sales Department, Goodyear, Akron 16, Ohio.

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A PRODUCT OF GOODYEAR RESEARCH

GOODYEAR
THE GREATEST NAME IN RUBBER

ALL OUT FOR THE MIGHTY 7TH—BUY MORE WAR BONDS

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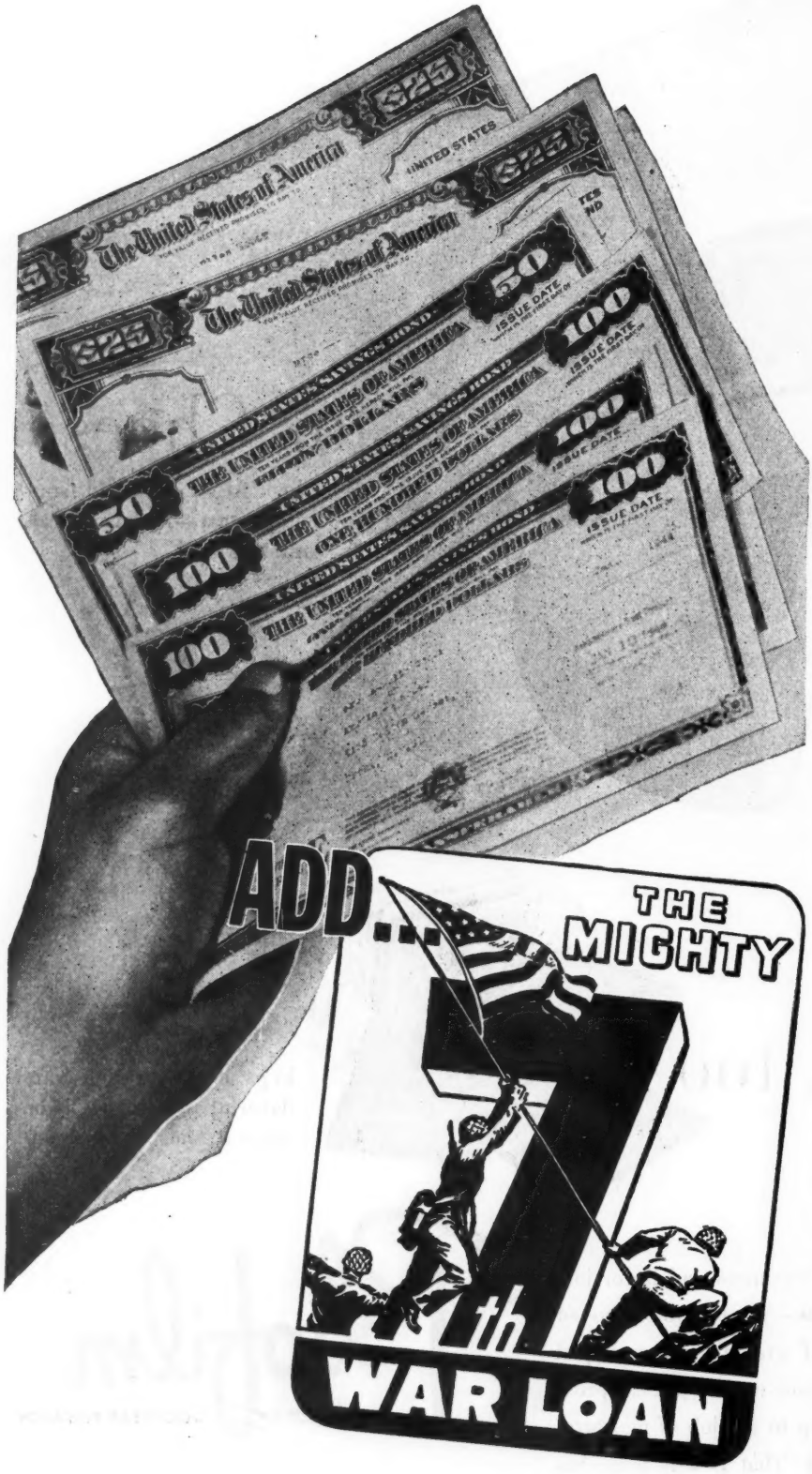

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The winter wheat crop, at 835,-

"...and, Gentlemen, speaking of postwar packaging..."

COATED LITHWITE IS GOING TO PUT MORE EYE-APPEAL AND BUY-APPEAL INTO OUR CARTONS"

SIX YEARS AGO, when Gardner-Richardson introduced *Coated* Lithwite, it caused a sensation. Here for the first time was a fine paperboard — formed, made and coated in one single high-speed operation.

SALESMEN, RETAILERS, CONSUMERS give it a big okay, for *Coated* Lithwite is brighter, more eye-appealing. Colors come up with greater brilliance on its smooth, velvety, chalk-free surface. Halftones print with sharp realism.

PRODUCTION ENGINEERS also give *Coated* Lithwite folding cartons a big okay. Precision-made for precision filling machines—*Coated* Lithwite cartons speed through with fewer jam-ups or delays. Score accurately without flaking or shattering. Take a positive seal.

CLIP THIS! **File this Coated Lithwite memo for reference when this quality paperboard is again available.**

1. Made by a revolutionary process. Coated Lithwite is the brighter, whiter paperboard that is formed, made and coated in one high-speed operation. Proved and improved for six years.

2. Means more eye-appealing cartons. Coated Lithwite's smooth, velvety, chalk-free surface forms a better base for printing inks and plates—reproduces even the smallest type cleanly, crisply. Brings colors up brilliantly—gives halftones a sharp realism.

3. Fewer jammers and leakers. Coated Lithwite scores without flaking or shattering. Takes a positive, tight seal.

The Gardner-Richardson Co.

Manufacturers of Folding Cartons and Boxboard

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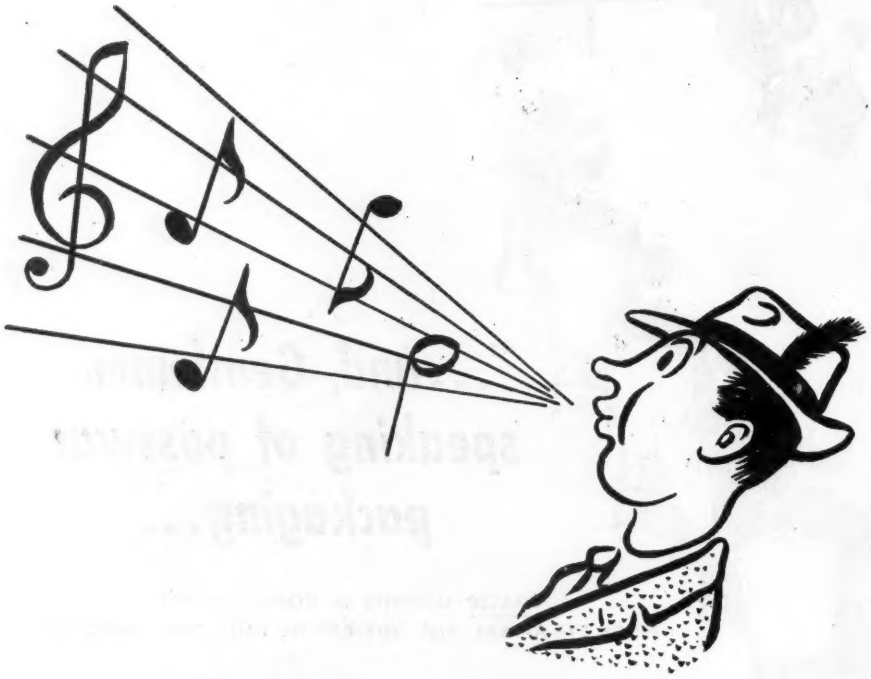
Sales Representatives in Principal Cities: PHILADELPHIA • CLEVELAND • CHICAGO • ST. LOUIS • NEW YORK • BOSTON • PITTSBURGH • DETROIT

CLEAN AS A WHISTLE



THAT'S the way your plant will be if you use Wyandotte Cleaners. There's one of these specialized products adapted to each and every cleaning and washing need you may have — whether it's washing equipment or aprons, cleaning floors or food utensils.

The Wyandotte serviceman is at your call, too—ready to help you get the most effective results from his complete line of Wyandotte Products. Talk over your particular problems with him at any time.

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REG. U. S. PAT. OFF.

WYANDOTTE CHEMICALS CORPORATION • J. B. Ford Division
WYANDOTTE, MICHIGAN — *Service Representatives in 88 Cities*

000,000 bu., still promises to be of record size. Supplies of spring truck crops are expected to exceed the record of last year. The May 1 condition of early Irish potatoes in ten southern states and California was slightly above average.

Apple prospects were not good, the indicated crop being much smaller than that of 1944. But peach production in ten early southern states was forecast at 25,239,000 bu., 50 percent more than last year. In the eastern cherry states prospects had deteriorated sharply since April 1, because of damaging frosts, but the outlook in Washington and Oregon was better than last year.

Citrus fruit production for the 1944-45 season was estimated at 108,380,000 boxes compared with 103,056,000 a year earlier.

For maple sugar and sirup, production in the 1945 season was the poorest on record. Maple sugar output was placed at 251,000 lb., or less than half last year's output. The outlook for sirup was even less favorable—990,000 gal., or less than 40 percent of last year's figure.

At mid-May, the continued cold, damp weather, accompanied by a heavy snowstorm in New England, was causing some uneasiness because the growing season had fallen behind schedule and farm work was seriously retarded in many areas.

Fats and Oils Quotas Lowered for Civilians

AFTER a survey of the available supply of fats and oils by the Interagency Committee, it has been found necessary for the War Food Administration to reduce raw material quotas for the manufacture of edible oil products and soap for consumption by United States civilians.

The reductions, effective for the second quarter, are made by amendments to War Food Orders 42 and 42b, bringing the quota for margarine to 110 percent, instead of 120, of the quantity used in the corresponding calendar quarter of 1944. For shortening, cooking and salad oils the quota is now 80 percent, instead of 83, of the average quantity used in these products during the corresponding calendar quarters of 1940 and 1941.

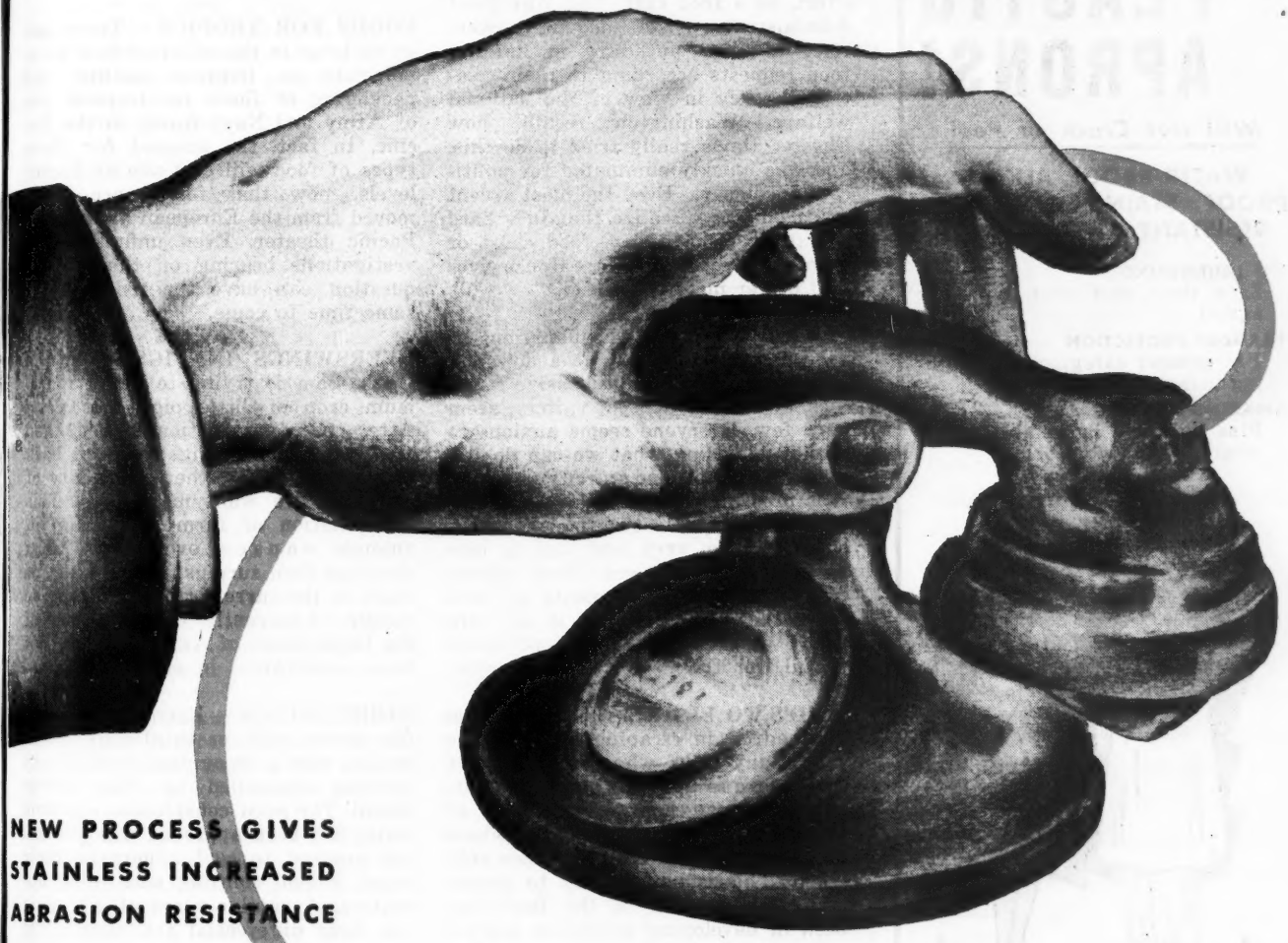
SCHEDULE OF EVENTS

JUNE

1-30—National Dairy Month.
Officially Cancelled
4- 5—Flavoring Extract Manufacturers Association, Chicago.
11-13—American Society of Refrigerating Engineers, Milwaukee.

WITHIN YOUR REACH!

LARGEST, MOST DIVERSIFIED WAREHOUSE STOCK OF STAINLESS STEELS IN AMERICA!



NEW PROCESS GIVES STAINLESS INCREASED ABRASION RESISTANCE

This efficient new process combines the corrosion resistance of Stainless with the abrasion resistance of a nitrided surface. Both austenitic and martensitic grades of Stainless now can be hardened.

Stainless Surface Hardening Company, 255 Bent Street, Cambridge 41, Mass. —a subsidiary of Industrial Steels, Inc.

JMLco C1-F1

LET ONE CALL DO IT ALL

WHEN YOU NEED STAINLESS STEELS!

Telephone Industrial first . . . then receive *all* your requirements from the largest, most diversified warehouse stock of Stainless Steels in America. Industrial's huge inventory includes scores of different items in Stainless — that's why *same-day* attention to your order is assured. What's more, you are charged *no premium over mill prices.* Remember . . . if its Stainless, Industrial has it. And don't hesitate to call on Industrial's expert metallurgists if you have a problem concerning Stainless. Free catalog sent on request. Industrial Steels, Inc., 250 Bent Street, Cambridge 41, Mass. TROwbridge 7000.

Everything in STAINLESS **INDUSTRIAL STEELS, INC.**

Basco-TEX

PLASTIC APRONS!

Will Not Crack or Peel

WATER-PROOF, ALKALI-PROOF, STAIN-PROOF, ACID-RESISTANT, OIL-RESISTANT

NO LAUNDERING
Save their cost over and over again!

TOPMOST PROTECTION
Far greater safeguard to clothing than ordinary aprons!

AMAZING STRENGTH
Plus lightness in weight for utmost wearing comfort!

4 COLORS

4 SIZES

——PRICES — SIZES — COLORS——

GRAY
27 x 36...$8.40 per doz.
30 x 36.... 9.78 per doz.
36 x 40... 11.00 per doz.
36 x 44... 12.60 per doz.
Full Length Sleeves $9.66 per dozen pair
Leggings, Hip Length $11.90 per dozen pair

BLACK NEOPRENE
27 x 36..$12.90 per doz.
30 x 36.. 14.00 per doz.
36 x 40.. 18.33 per doz.
36 x 44.. 20.50 per doz.
Full Length Sleeves $12.60 per dozen pair
Leggings, Hip Length $23.50 per dozen pair

ALL WHITE
27 x 36...$6.88 per doz.
36 x 36.. 7.65 per doz.
36 x 40.. 9.35 per doz.
36 x 44.. 10.18 per doz.
Full Length Sleeves $7.15 per dozen pair

OLIVE GREEN
27 x 36.. $6.27 per doz.
30 x 36.. 6.71 per doz.
36 x 40.. 8.35 per doz.
36 x 44.. 9.24 per doz.
Full Length Sleeves $6.60 per dozen pair

All Prices F.O.B. Chicago. Furnish best priority. Minimum order 1 dozen.

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What Washington Thinks

By R. S. McBRIDE, Washington, D. C.

FOOD CZAR—One-man management of the food problems of the nation seems absolutely necessary in order to straighten out the mess created by divided responsibility and political mismanagement. It is hoped that the new Secretary of Agriculture will, in effect, be a food czar. The War Food Administrator never adequately exercised absolute authority in limiting food requests according to their relative urgency in view of the national welfare. Washington recalls how Chester Davis really tried to do this, and was quickly eliminated for political expediency. Even the most ardent politicians now realize that it is hard to satisfy folks with a food chart or crop-goal program sheet. Housewives still prefer meat and bread.

A VAST SILENCE—Explanations of food shortage are a dime a dozen in Washington; but comprehensive remedies, even the crack pot variety, seem very few. Everyone seems anxious to remain silent on what we can do immediately about food scarcity now that it is pressing on every market basket in the country. Most of the comments, some of them very true, tell us how we got where we are. Many others tell us how to have plenty of food after the war. But few if any are really useful, or even pretend to be useful, for the next 6 to 18 months.

WHO'S TO BLAME—WFA has been most adroit in escaping major blame with many folks who are critical of the failure to get food enough to satisfy American housewives. Most of the talk, even in Washington where folks should know better, blames only OPA. This is not difficult to understand when much of the fault has been in developing attractive market prices for animals and crops. But that has been, and still is, a job for War Food since they fix *farm* prices.

ALCOHOL SQUEEZE—No letup in demand for alcohol will come until the Japs are finished and natural rubber again flows from the Orient. This means that alcohol for rubber making is in greater demand now than in any previous year of the war. Even so, the alcohol makers will not get much molasses or raw sugar. The sugar squeeze is even greater than the alcohol demand, especially politically.

FOODS FOR TROPICS—There can be no letup in the effort of food technologists to improve quality and packaging of foods for tropical use of Army and Navy forces in the Pacific. In fact, the demand for these types of food will continue at higher levels, now that forces are being moved from the European area to the Pacific theater. Even unfinished investigations bearing on this supply question can have top priority for some time to come.

OVERSWINGS IN PIGS—Again Uncle Sam is trying to get a maximum crop of little pigs this year. After record production in 1942 and 1943, the goals for pigs were cut back to save corn. Now there is plenty of corn and we want more pigs. This manipulation of farm production of animals causes overswings, first shortage then surplus, which explains much of the current trouble with food supply. Apparently the planners of the Department of Agriculture do not know moderation in either direction.

NIGHT BONUS—Extra wage rates for second-shift or third-shift workers are now a recognized part of pay systems controlled by War Labor Board. The most conspicuous example which has been approved was the extra granted to coal miners in their latest annual contract with mine operators. A similar extra of 7.5 cents per hour differential for night shift workers in certain canneries in California has come under criticism in Washington. This shows that when food plant managements start making new wage deals with their workers they must watch with great care for fine distinctions as to what is permitted and what is forbidden in the

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interests of "hold the line." And ex-V-E Day has not brought any relaxation of wage controls.

WAR CUTBACKS—W.P.B. did not wait for any official V-E Day to begin cutting back on military orders and schedules of war manufacturing. Some hundreds of millions of dollars for civilian production were authorized very early in May in the hope that reestablishment of normal industrial affairs could begin soon. Major objectives are, of course, serving urgent civilian needs, giving reemployment to those released from war factories and the Army, and avoiding of price inflation. This question of inflation is taken very, very seriously about Washington.

LIABILITY GROWS — Liability of food manufacturers under the Wage-Hour Law is much greater as the result of certain recent court rulings. Washington thinks that from now on a very literal observance of that law will be the only possible protection. The best evidence of this is the recent Supreme Court decision that an employee could not pledge himself not to bring suit later even though he accepted an overtime settlement from his employer. In other words, the punitive opportunity prevails in the court irrespective of justice or reason. Managements will have to plan settlements accordingly.

PLENTY OF STEEL—W.P.B. agrees that the steel industry can supply all war needs from now on "and still have available an amount well in excess of the average prewar civilian consumption." This means that manpower rather than scarce materials will now govern new construction and modernization programs in most cases.

LEASES PREFERRED—Surplus war factories will be leased rather than sold to industrial organizations wanting them for postwar civilian use. This general idea is advocated in Washington, especially by the Department of Justice, to prevent delay in getting these factories into use. Any food company may try to buy such factory facilities, but is likely to find that a lease can be more quickly arranged. The advantage is early availability. The disadvantage is that later on the Government is likely to ask more for the facilities when they have proven to be of substantial commercial importance. The question of lease or purchase is, therefore, one more big uncertainty to be faced when considering surplus Government facilities.

MORE SOCIAL SECURITY—One of the big issues in the near future affecting food plant raw materials will be the question of minimum wages and taxes for old age or unemployment social security on agricultural workers. If Washington plans prevail the labor cost in farm products is likely to be substantially raised.

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INDICATORS

Production

Frozen fruit and berry packs in 1944 skyrocketed more than 70 percent to total 322,500,000 lb., National Association of Frozen Food Packers reports. This great increase came principally from the 116,000,000 lb. increase in the pack of apples and applesauce, apricots, RSP cherries and peaches. Prunes and red raspberries were the only items not showing an increased pack in 1944. The amount of frozen fruits and berries packed in 30-lb. containers increased from 53,000,000 lb. in 1943 to 123,000,000 lb. in 1944, while the pack in barrels decreased from 44 percent of the total in 1943 to 32 percent in 1944. About 7 percent went into retail cartons and less than 1 percent into small institutional containers.

Frozen vegetable production in 1944 amounted to more than 234,000,000 lb., up 12½ percent over 1943 but a moderate increase compared to the 36 percent gain reported for 1943, according to National Association of Frozen Food Packers. The pack of lima beans was 41 percent higher than in 1943, spinach was up 30 percent; asparagus 28 percent; green peas, 13 percent. The pack of cut corn dropped a little, while that of snap beans slumped from 24,500,000 lb. in 1943 to less than 21,000,000 in 1944. About 44 percent of the total pack was in retail cartons, compared to 32 per cent in 1943 and 38 percent in 1942. Less of the pack went into institutional size containers.

Meat slaughtered in Federally inspected plants totaled more than 400,000,000 lb. less in April than in the same month a year earlier, according to American Meat Institute. April beef production was 19 percent below that of March, while veal was off 18 percent; lamb, 13 percent; pork, 13 percent. April pork production was 48 percent less than in April, 1944. Approximately 1,600,000,000 lb. less beef, veal, pork and lamb was produced in the first four months of 1945 than in the same period last year.

Flour milled in the United States during April amounted to 15,076,528 sacks, a gain of more than 2,000,000 sacks over the same month of 1944, *The Northwestern Miller* reports. April production, however, was slightly lower than the output reported for March.

Creamery butter production in March, estimated at 109,490,000 lb., was the lowest for that month since 1925 and 17 percent less than the 1934-43 average. The total for the first three months of this year was 300,807,000 lb., down 10 percent from 1944, and 18 percent below the 10-year average.

American cheese produced in March amounted to 66,030,000 lb., 13 percent more than in March, 1944, and 57 percent above the 1934-43 average.

Raw Materials

Rice production for the world will be slightly under that of a year ago and 5 to 10 percent less than prewar average. The 1944-45 crop is placed at 6,800,000,000 bu. China has the largest crop in five years, but production is below average in India, Japan and Japanese-occupied areas.

Milk production continued at a record level through April, total output on farms during the month being 10,800,000,000 lb., a 6 percent increase over April, 1944.

Egg production totaled 6,670,000 in April, 5 percent below April, 1944, but 27 percent over the 1934-43 average. There were 377,759,000 laying hens and pullets on farms in April—10 percent less than last year's peak.

Chicks on farms on May 1 totaled 456,738,000, 2.4 percent less than a year ago but 26 percent above the 10-year average.

Indexes

Business activity index of *Business Week* was 235.5 for the week ending May 12, as against 235.5 a month earlier and 237.7 a year ago.

Wholesale price index of foods, compiled by Irving Fisher, stood at 121.3 on May 11, compared with 120.5 on April 20 and 121.6 a year earlier.

Cost of living index of National Industrial Conference Board for April was 105.8. A month earlier it stood at 105.4; a year ago, 104.2.

CONSTRUCTION NEWS

	Pending (thousands)	Awarded May (thousands)	Total Awarded 1945 (thousands)
Bakery	$ 950	$	$ 163
Beverages	90	....	120
Canning and Preserving	130	177	1,060
Cold storage	695	121	1,223
Confectionery	....	....	150
Grain Mill Products	330	179	1,833
Ice, Manufactured	80	....	320
Meats and Meat Products	340	240	422
Milk Products	300	190	1,578
Miscellaneous	730	828	7,210
Complete 1945 total	$3,645	$1,735	$14,079

MEN • JOBS • COMPANIES

INDUSTRY

Birds Eye-Snider has begun construction of a new poultry plant at Pocomoke City, Md., to provide modern facilities for finish-feeding, dressing, eviscerating and quick-freezing of chickens.

Borden & Co., New York, has acquired the entire Pharmaceutical Division of W. F. Straub & Co., Chicago. The Straub unit, specializing in such products as amino acids, vaccines, vitamins and hormones, will be known as the Straub Laboratories Division of Borden & Co. W. F. Straub & Co. will continue its sale of food and soap specialties to food stores and institutional and industrial outlets.

Borden Ice Cream Co., Grand Rapids, has acquired the Stebbins Ice Cream Co., Saranac, Mich., and is moving the equipment to Grand Rapids.

The Campbell Soup Co. has entered the baby food field with the introduction of a new line of Campbell's Strained Baby Soups. Five baby soups, including chicken, lamb, liver, beef and vegetable are being distributed at present.

J. B. Carr Biscuit Co., Wilkes-Barre, Pa., has announced plans for postwar expansion which call for construction of a large plant at St. Louis. The new unit will house the Carr company's Midwestern baking and distributing facilities, augmenting those at Wilkes-Barre, Peoria, Ill., and Greenwood, S. C., and will provide employment for approximately 500 persons.

Harold H. Clapp, Inc. has opened a new $225,000 plant at San Jose, Calif., and H. W. Roden, president of American Home Foods, Inc., the parent company, announces that steps are being taken for further postwar expansion on the site.

Graham's Dried Foods, Ltd., Belleville, Ont., announces that the services of its laboratory and laboratory staff have been made available to all canners and food processors in the Hastings-Prince Edward County area of Ontario. The food laboratory is one of the best equipped in Eastern Ontario, and is under the direction of H. C. Aitken.

Jewel Food Stores recently launched a proposed chain of retail bakeries in connection with its food and meat stores in the Chicago area. The first shop was opened May 8 at Riverside, Ill., and the organization plans to produce a full line of standard baked goods. If the experiment is successful, a retail bakery will be established in every Jewel Food Store.

The Larsen Co., Green Bay, Wis., recently purchased the Fort Atkinson (Wis.) Canning Corp. Harold Bergmann is in charge of this plant.

National Canners' Association has announced that Alabama Products Canning Co., Inc., Roanoke, Ala. and Craddock Canning & Preserve Co., Paducah, Ky., have been admitted to membership in the association.

National Dairy Products Corp. plans to spend from $50,000,000 to $75,000,000 in the first five years after the war for new plants, equipment and trucks, according to L. A. Van Bomel, president. The expansion includes the purchase of 10,000 trucks, 50,000 refrigerator cabinets, and the construction of five buildings which, with equipment, will cost the company approximately $9,000,000.

LEROY J. TAYLOR

Libby, McNeill & Libby recently announced the promotion of Leroy J. Taylor to be general manager of the company's California Fruits Division. He formerly served as the division's assistant general manager, and succeeds W. A. Gellersen, who is retiring after 46 years service with Libby's.

National Dehydrators Association has moved its headquarters from Washington, D. C., to the Pure Oil Bldg., 35 East Wacker Drive, Chicago.

Pendleton Canning & Frozen Food Co., Pendleton, Ore., recently went into operation as the newest canning firm in Oregon. O. S. Ramsey, formerly with Smith Canning Co., is president of the firm.

Phillips Packing Co., Inc., Cambridge, Md., has been awarded a third white star for its Army-Navy "E" pennant.

Simplot Dehydrating Co., Caldwell, Idaho, is now operating the Bakersfield, Calif., Dehydrating Co. under lease from the War Food Administration. W. J. Carrier is superintendent of the plant.

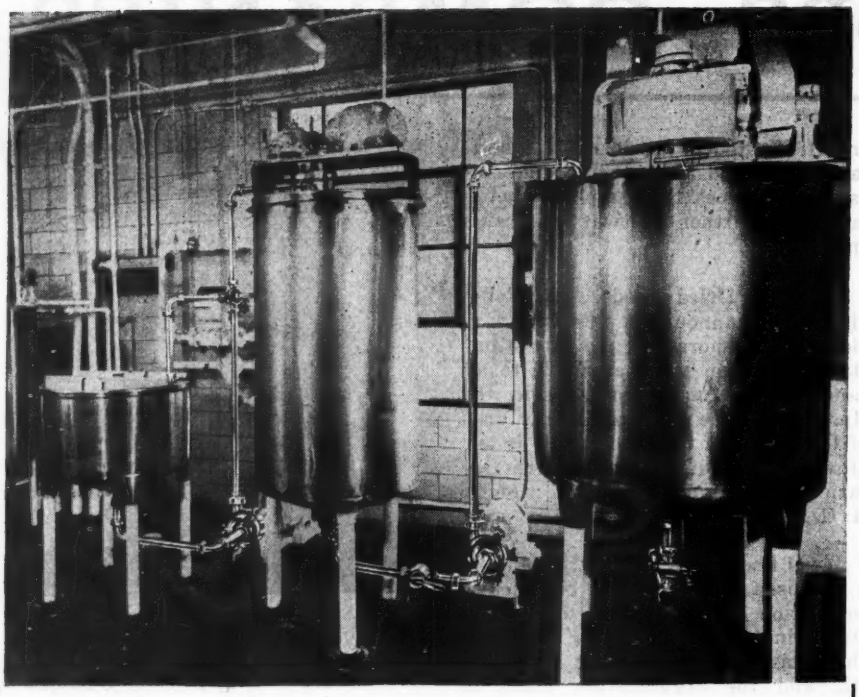
Spiegl Foods Co., Salinas, Calif., has installed quick freezing equipment and expects to begin freezing beef for the Army this month.

Swift & Co., is constructing a new turkey canning plant at Albany, Ore., at an estimated cost of $30,000. Packing operations are scheduled to begin about July 1 with a capacity of 2,000 turkeys daily.

J. G. Van Holten & Son, Milwaukee, announces that two buildings of its new $100,000 pickle and vinegar manufacturing plant at Waukesha, Wis., are nearing completion, and production is expected to get underway in July.

NEW CEREAL PLANT

This new Oakland, Calif., plant of Albers Milling Co. is one of the largest feed manufacturing plants in the world and is equipped with modern facilities for production of cereals and quality controlled feeds. There is also a unit for the production of soybean oil and corn oil.



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PERSONNEL

Milton J. Boyd has been elected vice-president in charge of production and labor relations of Pfeiffer Brewing Co., Detroit.

T. E. Brick is the new general manager for the Indianapolis headquarters plant of Stokely-Van Camp, Inc.

William E. Carter, formerly division manager for Kroger Grocery & Baking Co. in Cleveland, is now supervisor of the company's branches at Detroit, Grand Rapids, Toledo, Cleveland and Pittsburgh.

Edward H. Cooley, executive vice-president and manager of the Massachusetts Fisheries Association, Inc., has resigned to become president of the Atlantic Coast Fisheries Co., with headquarters at the Boston Fish Pier.

D. A. FitzGerald, who has been serving as special advisor to the Administrator, War Food Administration, is now also supervising functions related to allocation of food among claimant agencies. Mr. FitzGerald is also chairman of the Food Requirements and Allocations Committee.

Howard O. Frye was recently promoted to the presidency of Walter Baker & Co., Inc., Dorchester, Mass., a subsidiary of General Foods Corp. The announcement was made by Curtis H. Gager, General Foods vice-president and former head of the Baker company.

George Hallauer, associated with the Valley Evaporating Co., Yakima, Wash., was elected president of the National Apple Driers Association at their first annual meeting in Sebastopol, Calif.

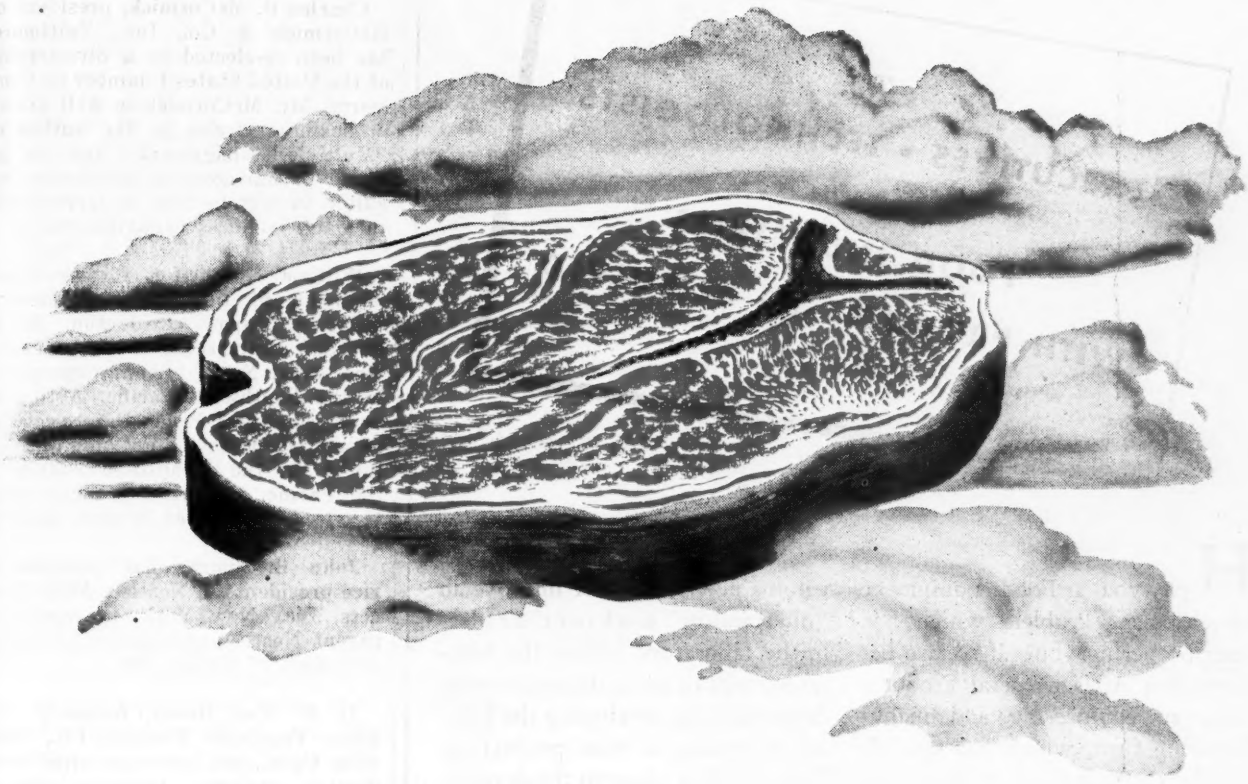
A. W. Hockenberger, for the past four years sales manager of the flour division of Schultz, Baujan & Co., Beardstown, Ill., has resigned to become vice-president and manager of the Red River Milling Co., Fergus Falls, Minn.

Robert W. Jones, formerly with the Roach-Indiana Corp., has purchased a corn canning plant at Arlington, Ind., to be operated as the R. W. Jones Canning Co.

Charles W. Kaufman, formerly director of the processing technology section at General Foods Central Laboratories, Hoboken, N. J., has been named assistant manager of the company's research and development department in New York.

Edward E. Kuphal has been appointed director of manufacturing at General Mills, Inc., Minneapolis, Minn. He was formerly assistant director of research.

Kenneth Lucas, formerly with the



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Columbia Conserve Co., Indianapolis, has acquired the Indiana Packing Co., canning plant at Arlington, Ind.

Charles P. McCormick, president of McCormick & Co., Inc., Baltimore, has been re-elected to a directorship of the United States Chamber of Commerce. Mr. McCormick is well known in business circles as the author of "Multiple Management," and his interest in management policies has resulted in membership or directorship in many business organizations.

William J. Scheffer, former superintendent of farming operations of Seabrook Farms, Bridgeton, N. J., left San Francisco recently to supervise Army-Navy farming operations in the Southwest Pacific. Acting as an Agricultural Production Specialist, he will supervise the growing of vegetables on the recaptured islands in the Pacific, the fresh produce going to our armed forces in that theater.

John B. Sparks has resigned as vice-president of Nestle's Milk Products, Inc., New York, to rejoin the parent Nestle organization as a vice-president of Unilac, Inc.

L. W. Van Doren, formerly with Basic Vegetable Products Co., Vacaville, Calif., has been appointed dehydration engineer, technical director and sales manager of Puccinelli Packing Co., Turlock, Calif.

DEATHS

William C. Doyle, 54, president and general manager of King Milling Co., Lowell, Mich., April 21, in Chicago.

Edwin A. Elliott, 61, northern division manager of Kroger Grocery & Baking Co., Detroit, March 21.

Harry A. Johnson, 64, retired production manager of American Can Co., Toledo, Ohio, April 14, in Fremont, Ohio.

James J. McManus, 60, founder and treasurer of the 20th Century Bakery, Inc., Haverhill, Mass., April 23.

Wm. S. Sellars, 58, formerly chief chemist, American Can Co., with headquarters in New York, April 15, at Auburndale, Mass.

Simeon H. Standley, 83, operator of a cheese factory in Corinth, Ohio, May 1.

Steve Toth, Sr., 67, president of Toth Packing Co., Youngstown, Ohio, recently.

Walter Trego, 61, former president of Hoopeston Canning Co., Hoopeston, Ill., April 26.

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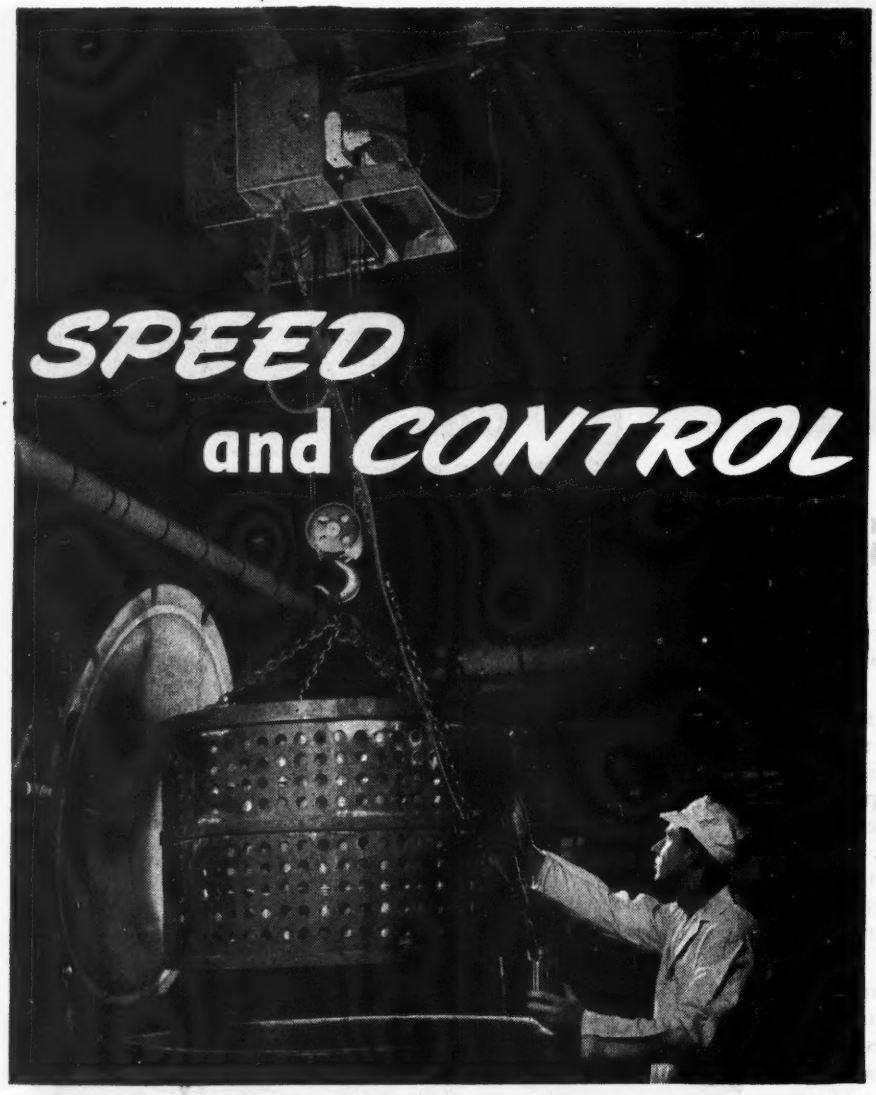

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Newark 8.....700 Bergen St.
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ASSOCIATED INDUSTRIES

Bristol Co., Waterbury, Conn., has appointed C. E. Mason as technical director in the manufacture of automatic control and recording instruments.

Food Machinery Corp. has purchased the Dayton-Dowd Co., Quincy, Ill., pump company. The newly acquired firm will operate as a branch of Food Machinery's Peerless Pump division, Los Angeles, under direction of Clarence M. Frazier, vice-president. Henry J. McKenzie will manage the branch.

Mack Trucks, Inc., New York, has made known the appointment of Harry Bernard as director of service and service engineering. He will be responsible for overall policy and management control of both units.

Louis H. MacLeod, for the past five years manager of the Chicago office of Lever Bros., has been transferred to the home office in Cambridge, Mass., where he will serve as regional manager for the Chicago, Pittsburgh, Detroit and Minneapolis markets.

Milprint, Inc., Milwaukee, has been awarded the Army-Navy "E" for its outstanding record in the production of scientific and protective packaging during wartime. The Rockford Division of Borg-Warner, Rockford, Ill., has been awarded a third white star for its Army-Navy "E" pennant.

Monsanto Chemical Co., St. Louis, has announced the election of Dr. Charles A Thomas, director of Monsanto's Central Research Laboratories at Dayton, Ohio, as a vice-president of the company.

W. J. Muller has been named manager of the Kansas City plant of the Chase Bag Co., having previously been sales manager for the firm at Denver.

Pneumatic Scale Corp., Ltd., North Quincy, Mass., has announced the appointment of N. Stanley Ross as vice-president and divisional sales manager.

H. K. Porter Co., Inc., Pittsburgh, Pa., has recently elected Colonel G. deFreest Larner as assistant to the president.

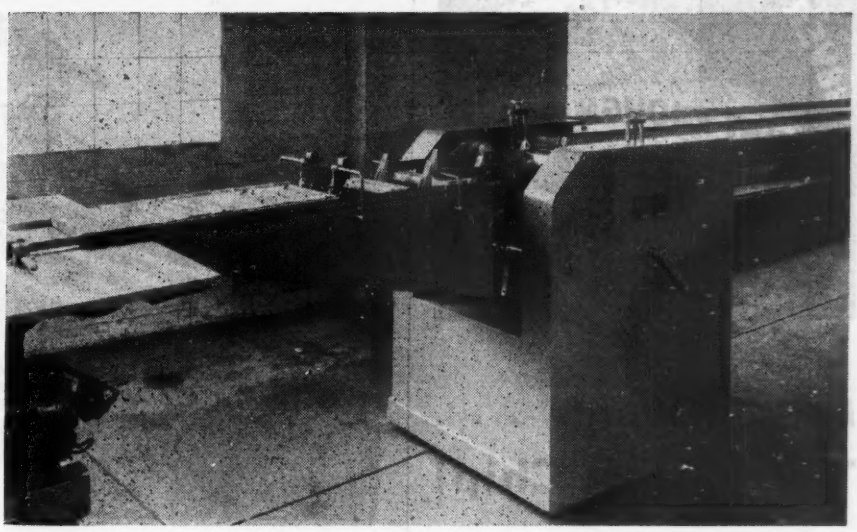
Stein, Hall & Co., New York, has expanded its Detroit branch under management of G. N. Streit. R. Swint heads the division specializing in food industry products.

United States Rubber Co., General Products Division, has recently appointed Howard W. Kelsey as sales promotion manager.

FOOD EQUIPMENT NEWS

Carton-Sealing Machine

IMPORTANT advances in carton-sealing equipment are said to have been made with the introduction of a fully automatic adjustable carton sealing machine made by Container Equipment Corp., 204 Riverside Ave., Newark 4, N. J. The new feature that has been introduced permits both top and bottom sealing of filled cartons simultaneously. A variable-speed control adjusts the machine speed to actual requirements. The feeder and sealing machines are said to be easily adjustable for a wide variety of carton sizes.



Improved carton sealing machine.

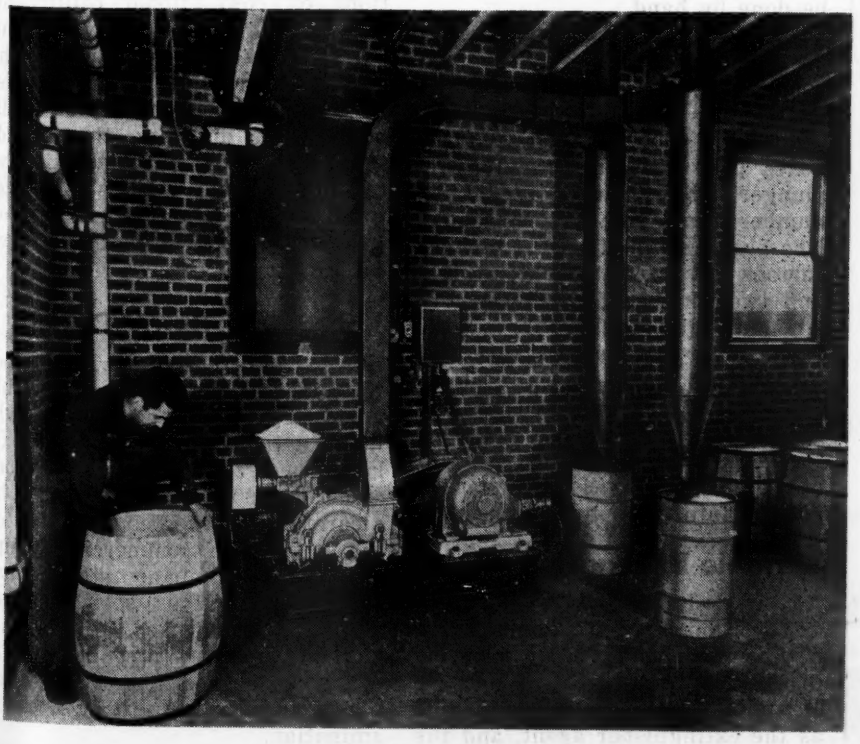
Screenless Pulverizer

ULTRA fine powders are said to be produced efficiently by the new screenless pulverizer manufactured by Pulverizing Machinery Co. Chatham Road, Summit, N. J. The manufacturer guarantees particle sizes as small as 1 to 2 microns on certain materials.

The principle of operation is a simple one. The raw material is fed into the mill from the customary hopper. After its initial breaking down by the rotating hammers, it is atomized by an air stream which carries the dispersed particles into a separator wheel where they are whirled about at the rate of from 4,000 to 7,000 r.p.m.

A fan adjacent to the separator wheel exerts just enough suction to draw out the finest particles and discharge them. But the centrifugal force holds the coarser particles against the pull of the fan, and these drop back into the path of the hammers to be rebeaten until they are fine.

The relationship between the radius and width of the separator wheels, which impart centrifugal force, and the radius and width of the fan blades, which produce the suction, determines the fineness and capacity of the machine on any given material.



Screenless pulverizer installation.

Side-Car Conveyor

INTENDED to convey bulk materials in large quantities, a side-car conveyor is announced by Link-Belt Co., 307 N. Michigan Ave., Chicago, Ill. This new unit provides conveyor storage for materials that are to be discharged simultaneously in varying quantities at a number of points. Any surplus material left in the conveyor buckets, after they have served the several discharge points, remains in the bucket to be recirculated. The conveyor is self-feeding from any one of many feed spouts which may be located above the horizontal path of travel. It is also self-discharging to any number of points, thus permitting continuous automatic operation. Another feature is that the material is carried in buckets supported on rollers rather than being dragged by flights in a trough. The design is such that two or more materials can be separately fed to the conveyor and it is claimed that the admixture will not be disturbed in transit. It will be delivered to any predetermined discharge point in the same mix proportions as prevailed at the feed point.

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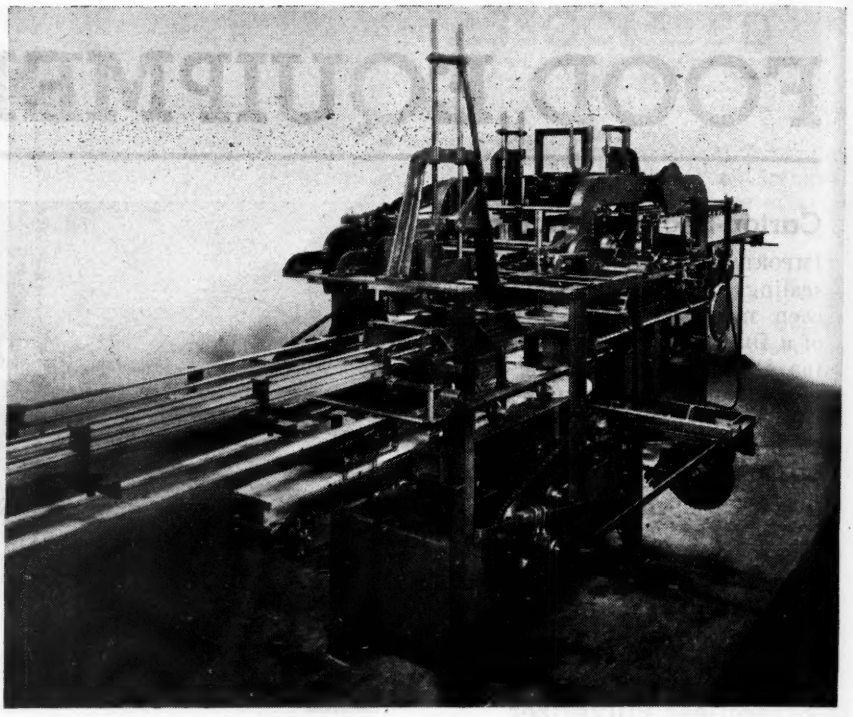

Automatic assembler for carton bundler.

Carton Assembler

PACKAGE MACHINERY CO. Springfield 7, Mass., has developed an automatic assembler for the F-10 bundler, largely used in packaging cracker and biscuit cartons. This assembler forms a direct link between the machine which wraps individual packages of crackers and the bundler, resulting in a continuous belt-like assembly operation. It is said to complete the operation four to five times as fast as it can be done by hand.

The assembler is 64 in. long and 28 in. wide at the base. The feed conveyor is 8 ft. 3½ in. long and its width is adjustable.

From a conveyor belt, cracker boxes pass beneath an automatic plunger which shoves a desired number into a receiving magazine. The plunger will stack the cracker cartons one, two or three tiers high, and two, three or more in width. An automatic pusher shoves the stacked cartons onto a turntable which, with its 90-deg. arc, places the cartons in the desired position for the type of wrapping wanted—lengthwise or widthwise. Still another pusher propels the stacked cartons into the bundling machine.

Portable Extinguisher

AMERICAN-LAFRANCE FOAMITE CORP., Elmira, N. Y., announces a new portable fire extinguisher made in three different sizes, Models 15, 10 and 4. These use carbon dioxide as the extinguisher agent, and the number indicates the pound capacity of the gas. The operating valve lever is directly above the carrying handle. It can be instantly operated by pressure on a hand grip. For continuous operation, a ring is slipped over the operating lever while it is depressed. All models are approved by the Underwriters' and Factory Mutual Laboratories.

Fiber Digestion Rack

IN running crude-fiber determinations on conventional equipment, one of the difficulties which impairs accuracy is frothing of the solution. The nonfrothing crude-fiber digestion rack is said to eliminate this difficulty, thus avoiding interference with quantitative calculations. The rack is manufactured by Precision Scientific Co., 1750 N. Springfield Ave., Chicago 47, Ill.

Laboratory Spray Dryer

BOWEN RESEARCH CORP., Garwood, N. J., has developed a new table laboratory spray-dryer which will fit on a table 3 ft. wide and 6 ft. long. The general design and construction of this unit is said to be a carefully engineered reduction of the large-scale commercial equipment. The company states that nearly all aqueous solutions and slurries can be dried on this unit and that in a few seconds a quart or two of solution can be changed to dry powder for testing and examination.

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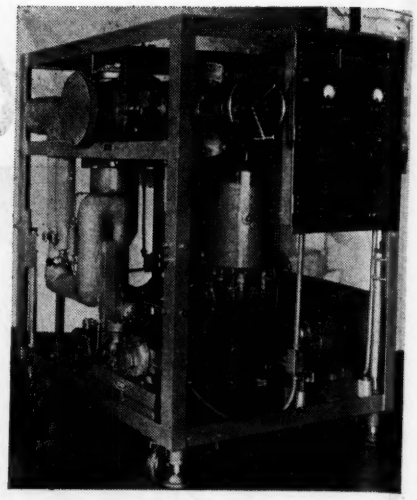

Packaged high-vacuum system.

High-vacuum System

A COMPLETE high-vacuum system—a small, compact unit for direct connection—is offered by Vacuum Engineering Division of National Research Corp., Boston 15. The unit is available in various capacities and ultimate vacuum, consisting of a mechanical forepump, diffusion pump, high-vacuum valves, gages and control panel.

Spray Nozzle

PERFORMANCE to predetermined specifications is possible with a spray-drying nozzle introduced by Spraying Systems, Inc., 4061 West Lake St., Chicago 24. As an example, if a dryer is set to use a pressure of 5,000 lb. and the liquid to be spray dried can be delivered to the nozzle at the rate of 53 gal. per hour a nozzle can be selected from a great variety of sizes, that will deliver exactly that capacity. These spraying nozzles have renewable cores and orifice inserts. Orifice inserts are heat treated and lapped, and are available in either hardened steel or tungsten carbide, with flat or cup tops. The pressure range is 1,000 to 7,000 lb., and there are 85 separate combinations of orifice and core sizes and types.

Spray-nozzle assembly.

CATALOGS, BULLETINS

FOOD PLANT EQUIPMENT

Band Ovens, Cooling Conveyors—Folder No. 44-2 has just been issued by the J. W. Greer Co., Cambridge 39, Mass., showing photographic installations and drawings of complete band oven units and cooling conveyors.

General Equipment—First Machinery Corp., 9th St. and East River Drive, New York 9, has just issued a 98-page Catalog No. 45 illustrating and describing many kinds of equipment. The catalog also has a very comprehensive index, making its contents easily available.

Pro-Coating Booklet—At the request of the Quartermaster Corps, American Can Co. has prepared a revised edition of "The Pro-Coating of Processed Food Containers." It contains the more recent developments in machinery and technic in pro-coating food containers.

Pulverizers, Grinders and Mixers—Pulverizing Machinery Co., Chatham Road, Summit, N. J., has issued a bulletin describing new mechanical screenless pulverizers for the production of ultra-fine powders from 1 to 25 microns.

Conveyors—Giving detailed information on gravity and power conveyors of various sizes and kinds, booklet No. 60 has just been issued by Standard Conveyor Co., North St. Paul 9, Minn. Various types of roller and wheel conveyors are illustrated and described. There also are illustrations and descriptions of different types of power conveyors and their respective uses.

Electronic Control—Wheelco Instruments Co., Harrison & Peoria Sts., Chicago, has issued a 12-page catalog on Electronic Controls. Designated Z-6300, it lists the principal items of equipment supplied by the company. The bulletin also describes the principle by which control is effected, without contact, between measuring and control units of an instrument, and gives brief descriptions and prices of indicating pyrometers, pyrometer controllers and other control equipment.

Heat-Transfer Equipment—Bulletin No. 645 issued by the Whitlock Mfg. Co., 48 South St., Elmwood, Hartford 1, Conn., describes and illustrates their heat-transfer equipment, which include shell and tube, and coil types. The bulletin illustrates a number of designs of tube bundling and closure construction, and specifies individual product data, including fuel oil heaters, water heaters, and power plant equipment.

Diesel Power—"Over 50 Years of Leadership," a new booklet released by Caterpillar Tractor Co., Peoria, Ill., highlights major contributions of the solution of power problems by the company and its predecessors. Records of diesel performance and profit are given on a wide range of jobs, and dealer-service facilities also are highlighted.

PLANT SUPPLIES

Frozen Food Packaging Materials—A. E. Macadam & Co., 95 Lexington Ave., Brooklyn 5, has just issued a 1945 supplement covering new packages and new equipment for frozen food packers and frozen locker plants.

Corrosion-Resistant Concrete—Concrete floors, drains and machinery foundations, which are said to resist the corrosive action of dairy and meat-packing plant wastes, are described in a new 16-page booklet published by Atlas Lumnite Cement Co., Chrysler Building, New York 17. Illustrations show floors that have been in service in such plants for ten years or more. A question-and-answer section gives pertinent facts about the nature and use of calcium-aluminate cement and the characteristics of corrosion-resistant concrete. Detailed information on aggregates, proportions of mix and methods of placing concrete is included.

Smooth-surface Chain Belt—In addition to describing and illustrating a smooth-surface chain belt, a new 16-page catalog by Chain Belt Co., 1600 W. Bruce St., Milwaukee 4, contains illustrations of the belt's application in bottling, labeling, peeling and capping operations. Engineering data and prices are included.

Synthetic Rubber Gloves—A new bulletin on synthetic industrial rubber gloves has been published by B. F. Goodrich Co., Akron, Ohio. Part of it is devoted to illustrated instructions on how to get the most service from industrial rubber gloves. Another part pertains to plastic-treated industrial aprons.

V-Belt Drives—All the information required to make correct drive selections is contained in a new 12-page catalog by Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.

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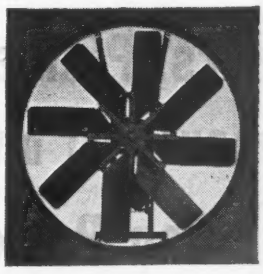

Keeping workers comfortable is one of the most important factors in maintaining an efficient working organization. If the change of air is not sufficient for comfort, the amount of work an employee can perform in a given time is seriously affected.

Manufacturers, processors, packers and other handlers of food products, whether or not directly engaged in war contracts, are authorized under present government regulations to assign high priority ratings to orders for Coolair Fans.

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Letters to the Editor

Butter Situation Calls for Action

To the Editor
Of Food Industries:

It is a rare occasion that I get the urge to write an editor upon a controversial subject. However, you have apparently incited me to such action by your editorial comment under the heading, "Decline in Butter," which appears in the February, 1945, issue of your estimable journal.

I earnestly wish that someone with the broad-gage viewpoint of a leader in the butter industry would wise-up the allied food industries and consumers relative to the *status quo*, on a strictly rational and scientific basis, rather than on an emotional one. After all, I'm merely a food technologist who has something of a soft spot in his heart for butter.

However, to start off, let me quote from the *D.P.M.A. News* of January, 1945:

"In 1940, when U. S. farms shipped a total of 109.5 billion pounds of milk and butterfat equivalent to market, butter had received and used 35.2 percent as its share of the year's supply.

"Of 1941's larger supply—115.5 billion pounds—butter had used 34 percent of the total.

"In place of 1940's 35.2 percent, butter in 1944 had taken only 26 percent of the milk supply. It was a loss of 3.6 percent for the year, a loss that meant 11.2 percent less milk supply for butter than in 1943.

"In three years, annual butter production had dropped from 1941's 1.9 billion pound output to 1944's 1.5 billion—400 million pounds that would have offset the war needs of the Army, the Navy and Lend-Lease. For the year alone, the drop in production reached 188 million pounds, 5 weeks of normal U. S. consumption.

"Loss of another 188 million pounds in production would reduce this year's creamery output to some 10 lb. per person, an output that normally reached 17 lb. per person. With military and Lend-Lease needs supplied, the civilian share of 1945 production could provide little more than 8 lb. per person against the normal 16 lb."

From the above quotation, you certainly get a partial answer to your question.

Vitamin Problems

To leave the political economy phases of the question, which can be better discussed by someone more conversant with all the details of rationing, subsidies and official attitudes than is my ken, I would direct attention to some of the other aspects needful of consideration in any broad understanding of the problem.

The National Research Council, in its preliminary studies of the nutritional problems posed by war, early gave consideration to the desirability of fortifying margarine to a standard of 9,000 units of vitamin A. his was done presumably under the assumption that, on an overall basis of seasonal and sectional influences, a potency probably in excess to that found in butter might be guaranteed—all doubtlessly arrived at by careful analyses of available information.

Since that time a nation-wide survey of the vitamin A content of butter at different periods of the year and in different parts of the country has been undertaken. The results of this survey, which have not been officially reported, are reputed to show in most instances that the 9,000-unit figure was much too conservative. In many instances, even winter-time butters have been found to exceed such a figure by generous amounts. Obviously, early publication of the actual results would be a public service of the first order.

Whatever the facts revealed by the survey, since the vitamin A content of butter directly reflects the feed given to the cow, it would appear only the better part of wisdom, on the part of the butter industry, to encourage and foster more extensive research with the object of bringing about a recognition of any need or supplementary fortification in the diet of animals.

There is also another viewpoint relative to the nutritional value of butter that deserves mention and consideration. In resorting to further studies directed at establishing the facts concerning the vitamin A potencies of different butters, it may be that the industry is guilty of taking defensive measures only. As a matter of fact, there are ample grounds for some disinterested students to take the position that the butter industry has so long relied upon defensive tactics that it has forgotten the truth of the adage, "a good offense is the best defense."

With this observation in mind, it is obvious that the butter indus-

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try might well encourage and foster nutritional research directed at the discovery of new vital accessory factors—a field in which the surface remains to be scratched!

The Road Back

Passing on to other vistas apparent to at least one technologist, and obvious also to some leaders, we come to the quality problem. This is an aspect of the industry which has inspired considerable window dressing that has fooled no one—least of all, the regulatory agencies. True, it is not an easy problem to change habits of 25 years' standing overnight, especially among marginal producers who from all evidences contribute the bulk of the cream supplies going into the manufacture of creamery butter.

Rather than be accused of assuming the mantle of a common scold, let me resort to quoting a few pithy and current news items.

Nothing has brought the truth of the quality trends in milk and cream production into sharper focus than the recent statement of the D.P.M.A. in its discussion of the butter situation. This is quoted in substance below:

"Butter faces a long road back to the reoccupation of its larger urban markets . . . Its quality has slipped away. Its facilities and equipment are worn thin. Its operating margin is almost gone. But more basically, butter has lost its capacity to produce. In this long road back there will be three stretches:

"1. Rebuilding the producer level.
"2. Reestablishing the quality.
"3. Rewinning the markets.
"With the turn of the season, these three should be begun."

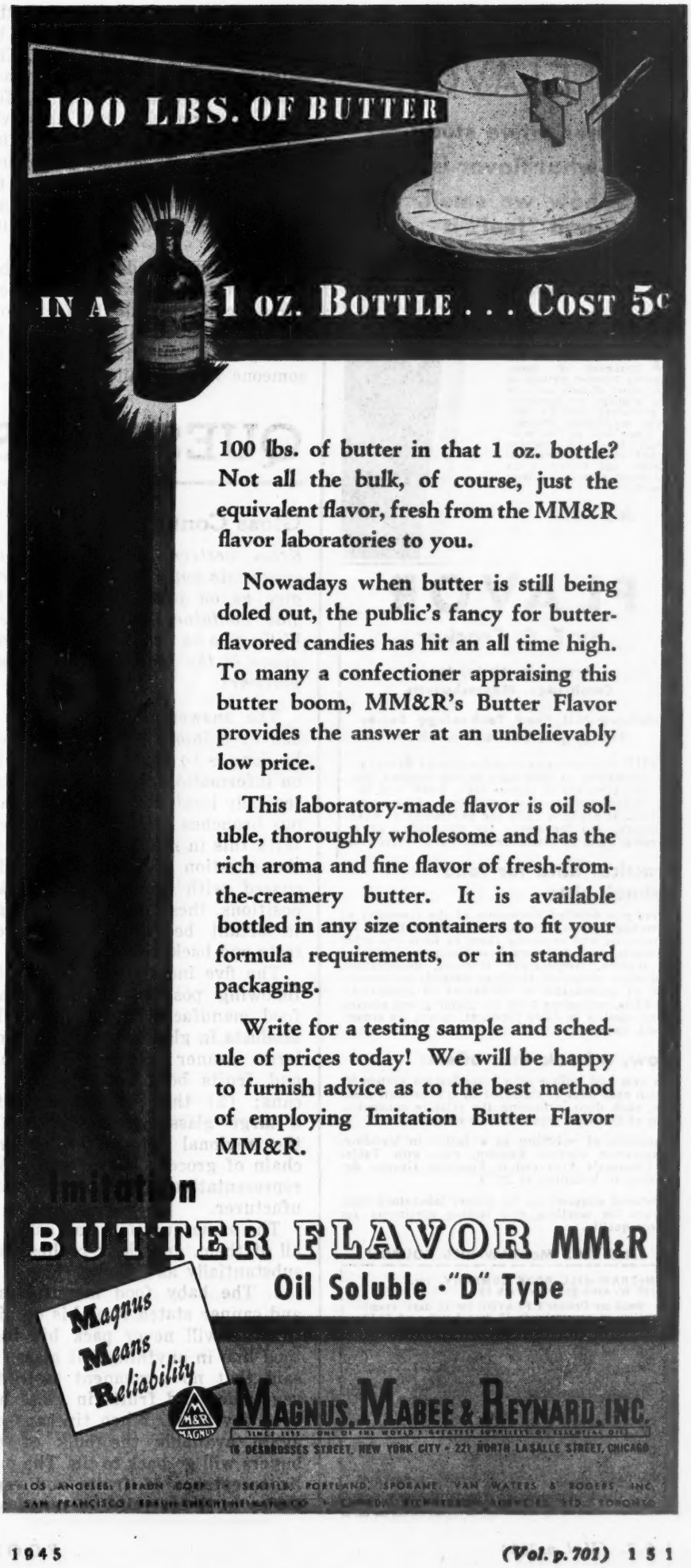
The italics are my own.

The above statement is mute evidence that transcends any partisan and partial criticisms, and as a footnote to the same, permit me to proceed to quote a news item in the Feb. 14, 1945, issue of *The Daily Record:*

"Denver, Colo.—Charles W. Crawford of Washington, Assistant Commissioner of the Federal Food and Drug Administration; Henry W. Welch, Chief of the Microanalytical Division; J. O. Clarke, Chief of the Central District, Chicago; and John L. Harvey, Chief of the Western District, San Francisco, arrived in Denver this week to formulate a regulatory control program affecting primarily the dairy industry.

"The quality of dairy products is being studied in the office of Wendell Vincent, the Denver Station Chief, in the new custom house."

Thus, with the evidence at hand, it would appear that the dairy industry, as well as the creamery but-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- a new and unique odor classification system by which each odor is classified by a four-digit number, each digit indicating the relative concentration of the four types of odor components.
- analysis of volatility as a factor in blending, evaporation control, fixation, etc.—with Tables of Chemicals Arranged in Fourteen Groups According to Volatility at 20° C.
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ter industry (as a part of the whole), is forewarned—and to be forewarned is to be forearmed. The dairy industry needs vigorous leadership as well as unanimity, for there is room for vast improvement, not only in the creamery industry but in the market and manufacturing milk divisions, which no one knows better than the officials of the U. S. Food & Drug Administration.

Before any leadership can become manifest, however, it is perhaps urgent that all the facts conerning butter and its *status quo* be clearly and impartially stated by someone who has all the facts.

To get back to your gastronomic inquiry—there appears to be a danger that a reduced appetite for butter might be the culmination of the present privations unless the present *status quo* is clearly and impartially clarified. Even beyond this urgency, however, there apparently is need for aggressive and progressive leadership which will embark on an offensive and abandon the outmoded and ineffective tactics of an apparent holier-than-thou attitude.

All of which I have unfolded more in hopefulness than in anger. —MILTON E. PARKER, *Consultant*, Chicago, Ill.

QUESTIONS & ANSWERS

Glass Containers

From western New York—Would appreciate any information you can give us on postwar prospects for glass containers for food products. Will glass container expanded usage in the food field be retained postwar?

The answer to this question is one of opinion. The best that can be done is to base such an opinion on information obtained from strategically located people in the various branches of the food business. With this in mind, on a recent trip the question was asked and discussed with four people in key positions, these men's opinions are important because of their contacts and background.

The five individuals were in the following positions: (1) A baby food manufacturer who packs his products in glass and who is also a large canner packing vegetables and fruits both in glass and in cans; (2) the representative for a large glass manufacturer, (3) the regional buyer for a large chain of grocery stores, and (4) a representative of a large can manufacturer.

The same question was asked of all of them, and their replies were substantially as follows:

1. The baby food manufacturer and canner stated it as his opinion that he will never pack his baby food line in anything but glass. He said that no permanent taste for vegetables and fruits in glass had been developed. When tin cans are again available the bulk of the buyers will go back to tin. The public acceptance of fruits and vegetables in tin is quite universal and buyers will eventually go back to it.

2. The glass manufacturer's representative, whose views are regarded highly, stated that as a result of the present dislocation in the availability of containers that glass containers would probably retain some of the new markets after the war. As a result of the tin can shortage, many new products have had to go to glass. In doing so they have discovered some advantages which they did not know existed. He spoke particularly of hydrogenated oils, shortenings, coffee and apple sauce. Market surveys have been made by the manufacturers on these products to try to determine whether consumers will prefer glass containers and whether this preference will continue after the war. He said that there had been three or four of these surveys made and each one of them clearly indicated a definite preference for glass. In general, he felt that some of the gains made by the glass containers will be retained after the war, although these would probably not be very large.

3. The grocery chain store regional buyer gave it as his opinion that just as soon as tin was again available, glass, on account of its higher price, even though it is only a matter of a couple of cents a jar, would be looked upon as a luxury item. He was very definite in his conviction that nothing would replace tin as a container for food.

4. The tin can manufacturer's representative was very definite in stating that "glass didn't have a chance."

The reactions expressed by No. 1 and No. 2 seem the most reliable.

Glass still requires more manual work than does tin, especially in retorting. It is generally accepted that glass losses are somewhat higher than tin can losses due to breakage and spoilage. For foods affected by light, the argument is in favor of tin whereas for foods that show up attractively the argument is in favor of glass.

Southern Fried Pies

From the Middle West.—I would like some information on the manufacture of Southern fried pies. Can you tell me how these are made and do you have a recipe for the dough as well as for the filling?

We have never encountered "Southern fried pies" in the South but there are places in Harlem (New York City) that offer this specialty.

The Southern fried pies are produced in Harlem as follows: A crust is made and filled with either mincemeat or any kind of fruit or fruit mixture. The crust is folded over the filling and the entire piece is then fried in deep fat, like doughnuts. Generally, the filling is fairly highly spiced.

It is possible to use either a crust mixture made with pastry flour, shortening and water in the proportion of 10 lb. of flour, 3 lb. of shortening and 4½ lb. of water, or a sort of sweetened biscuit mix. A second type is made with 2 lb. of powdered sugar, 6 oz. of shortening, 10 eggs, 2 quarts of milk, 8 lb. of soft wheat flour, 3 oz. of baking powder, ½ oz. of salt and ¼ oz. vanilla. This is made up by beating the shortening with the eggs, then adding the liquids and finally blending in the flour. The frying temperature suggested is from 385 to 390 deg. F. The product is then drained and cooled on screens.

As previously mentioned, the filling can be mincemeat or apples, berries, pears, peaches, apricots, figs, plums, pineapple, cherries or a mixture of fruits. Another suggestion is slices of apple, cut as disks, cooked in sugar and then drained and cooled. One of these can be used for each little "pie."

One important trick is to wet the edges of the paste before pressing them together. This prevents the filling from coming out in frying. As for equipment, it would seem that practically any doughnut-frying equipment would prove satisfactory, provided the size of the pies is adapted to it.

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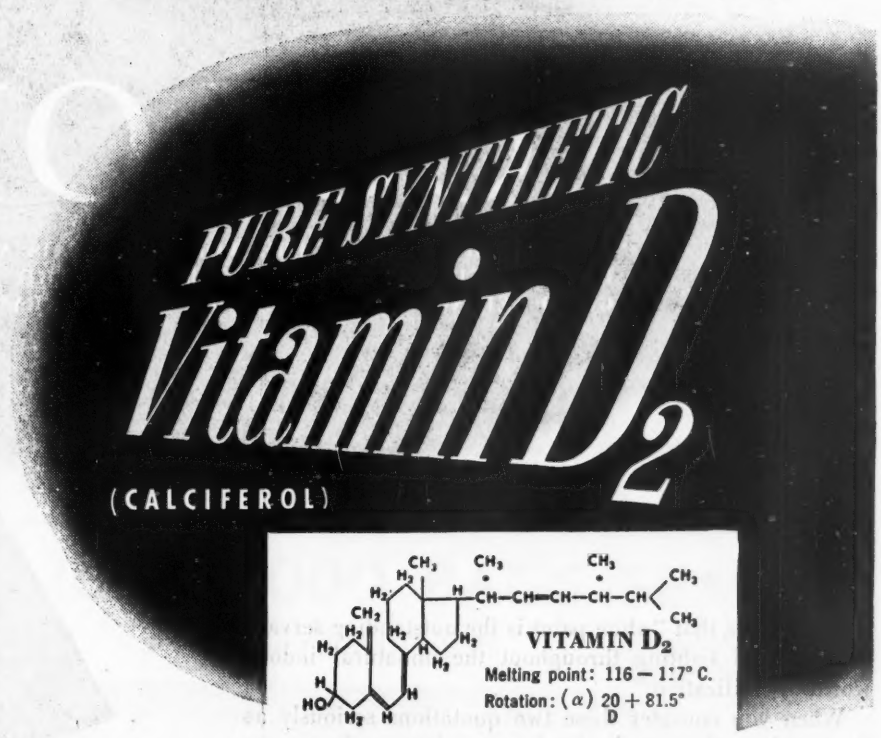

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400 Standard Units in one pint
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Also Solution in Corn Oil: 200,000 U.S.P. Units per gram packed as follows:
250 Standard Units in 5¼ oz. amber bottle
500 Standard Units in 9¼ oz. amber bottle
3,000 Standard Units in 5 gallon carboy
10,000 Standard Units in 15½ gallon drums S/S

*Standard Unit=1,000,000 U. S. P. Units

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BOOKS

Technology of Flavor

FLAVOR. By Ernest C. Crocker. Published by McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 18. 172 pages; 5½x8½ in.; cloth. Price, $2.50.

This is the first book in the publisher's projected series on food technology. It fills a barren spot in the literature on food, as flavor has hitherto been largely neglected. It also reflects the mounting industrial interest in the subject, both in this country and in England, and should be of value to people in all branches of the food industry—research, processing, merchandising and dietetics.

Both the practical and the theoretical aspects of flavor are comprehensively covered in the book's 15 chapters. The chemistry of flavoring agents and condiments and the means for retaining them in processed foods are discussed. Equally important to the food manufacturer are the methods outlined for the prevention of undesirable or off-flavors in commercial products and for the discovery and correction of such as may occur.

But flavor is a psychological as well as a physical phenomenon and, if it is to be truly understood, requires a study of the theoretical aspects. These aspects are covered in the early chapters under such headings as The Elements of Flavor, The Physiology of Flavor Perception and The Psychology of Flavor.

The book as a whole is intended to stimulate the thinking of food technologists. While it provides information about flavors and flavoring agents and methods of using them, it is not a recipe or formula compendium, nor does it deal with the subject matter now covered in cookbooks.

A Study of Labeling

GRADE LABELING AND THE CONSUMER. Issued by National Publishers Association. Distributed by Periodical Publishing Co., 271 Madison Ave., New York 10. 98 pages; 8½x11¼ in.; paper. Free to specified groups, including food manufacturers.

With the Grocery Manufacturers of America getting off to positive action by the inauguration of their descriptive-labeling campaign, this booklet offers a timely and informative study of the whole controversial subject of descriptive versus grade labeling.

It is an easy-to-read study that gets down to the facts and ignores, as far as possible, the unfortunate emotional appeal that has too often characterized labeling discussions.

GOVERNMENT PUBLICATIONS

FEDERAL SPECIFICATIONS FOR FOODSTUFFS — CONCENTRATED. N-F-211b. Available from Superintendent of Documents, Washington 25, D. C. STUFFS — CONCENTRATED. N-F-211b. Price 10 cents. A specification to guide Government purchasing effective in this revision of December, 1944.

PRODUCTION OF MANUFACTURED DAIRY PRODUCTS 1943. Bureau of Agricultural Economics. Mimeographed free from Bureau. A resume of official figures for all the major manufactured dairy products.

REPORT ON THE AGRICULTURAL EXPERIMENT STATIONS, 1944. Agricultural Research Administration. Available from Superintendent of Documents, Washington 25, D. C. Price 20 cents. This is a summary of research results obtained and recommendations made by the State stations cooperating with the Federal Government.

AGRICULTURAL STATISTICS 1944. Department of Agriculture. Available from Superintendent of Documents, Washington 25, D. C. Price $1.00. A complete reference data book on grains, animals, and other agricultural products.

THE BUSINESSMAN'S BUREAU. By Corrie Cloyes. Bureau of Foreign and Domestic Commerce, Economic Series No. 40. Available on request to the Bureau of Foreign and Domestic Commerce, Washington 25, D. C. A description of the service available and the types of activities carried on by this bureau.

ANNUAL REPORT, FOOD AND DRUG ADMINISTRATION 1944. Federal Security Agency. Available from Superintendent of Documents, Washington 25, D. C. Price, 15 cents. A resume of activities for the year ending June 30, and a general statement of policy.

PICKING MATURITY OF APPLES. By Mark H. Haller. Department of Agriculture, Circular No. 711. Available from Superintendent of Documents, Washington 25, D. C. Price, 10 cents. Summarizes orchard practice as related to market usefulness by variety of apple.

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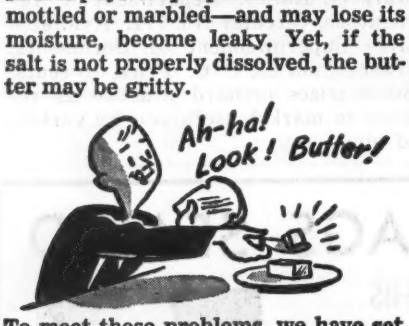
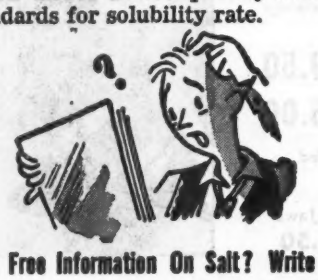
Take solubility: In salting cheese, slow solubility is highly important and desirable. Otherwise, salt is lost in the whey, producing flat, under-salted cheese. On the other hand, in salting butter, salt must dissolve with lightning speed. If the butterfat is on the soft side—lacking in body—at certain seasons, butter salt must dissolve so quickly that over-working is avoided. Otherwise, the butter may lose its desirable physical properties and become mottled or marbled—and may lose its moisture, become leaky. Yet, if the salt is not properly dissolved, the butter may be gritty.



To meet these problems, we have set up definite solubility standards for Diamond Crystal Salt. Our Butter Salt, for example, dissolves completely in water at 65° F. in less than 9.8 seconds—average rate, 9.2 seconds. That is why so many quality-minded food processors have learned to depend on Diamond Crystal products, manufactured under strict quality-control standards for solubility rate.



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If salt solubility enters into your processing, write to our Technical Director. He will gladly recommend the correct Diamond Crystal Salt for best results. Diamond Crystal, Dept. J-12, St. Clair, Michigan.

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PATENTS

Fish Press Liquor Treated for Recovery of Oil, Coagulable Protein, Clarified Serum and Water-soluble Vitamins—Sven H. Lassen, Los Angeles, Calif., one-half to Phillip R. Park, Inc., San Pedro, Calif., and one-half to Van Camp Sea Food Co., Inc., Terminal Island, Calif. No. 2,372,677. April 3, 1945.

Yeast and Alcohol Produced from Fermentable Saccharine Material—Gustave T. Reich, Philadelphia, Pa. No. 2,372,-[illegible]4. April 3, 1945.

Beverages Bottled by Use of Combination Bottle Filler and Siruper—James Cantor, to Liquid Carbonic Corp., Chicago, Ill. No. 2,372,899. April 3, 1945.

Technical Acid-precipitated Casein processed for Removal of Such Impurities as Lactalbumin—Luzius Schibler, to Society of Chemical Industry in Basle, Basel, Switzerland. No. 2,372,-986. April 3, 1945.

Sugar Sirups or Melts Refined by Action of Bone Char Followed by Action of Powdered Activated Carbon Mixed With Finely Granular Petroleum Coke—Leonard Wickenden, Manhasset, N. Y. No. 2,372,996. April 3, 1945.

Bread Doughs Molded Into Loaf Form by Mechanical Means—Albert W. Burdett, New York, Richard Tannous, Pelham Manor, and Albert E. Tolley, Garden City, N. Y., to Ward Baking Co., New York, N. Y. No. 2,373,012. April 3, 1945.

Cornstarch Modified by Heat at About 10 to 12 pH, Acidified to pH of 4 to 6; Subsequently Washed to Remove Soluble Material—Raymond E. Daly and Frederick A. Frankenfield, Chicago, Ill., and Herman H. Schopmeyer, Hammond, Ind., to American Maize-Products Co. No. 2,373,016. April 3, 1945.

Ravioli and Similar Pastries Mechanically Cut and Trimmed—Homer Gamache, to Acme Metal Goods Manufacturing Co., Newark, N. J. No. 2,373,-182. April 10, 1945.

Glutamic Acid Recovered From Thin Steffen's Waste Liquor by Improved Method—Celestian L. Royal, Toledo, Ohio, to International Minerals & Chemical Corp., Chicago, Ill. No. 2,-373,342. April 10, 1945.

Lean Meat Separated From Fat Tissue by Mechanical Means—Charles T. Walter, to Industrial Patents Corp., Chicago, Ill. No. 2,373,361. April 10, 1945.

Coconut Cut Automatically by Power-Driven Mechanism—Leandro Malicay, Los Angeles, Calif. No. 2,373,584. April 10, 1945.

Carotene Concentrate Prepared by Pulping Carotene-containing Vegetables, Washing Free From Fibrous Material With Water, Coagulating Carotene Particles and Separating From Excess Water—Harold M. Barnett, Long Beach, Calif. Reissue No. 22,629. April 17, 1945.

Fruits Bagged and Weighed in Combination Mechanical Unit — John C. Broome, Dunedin, and Henry D. Carlton, Highlands City, Fla., to Food Machinery Corp., San Jose, Calif. No. 2,-373,649. April 17, 1945.

Frozen Eggs in Block Form Thawed During Rotation of Block While Subjected to External Heat—George F. Hodson, Oklahoma City, Okla., to Wilson & Co., Inc., Chicago, Ill. No. 2,-373,682. April 17, 1945.

Chocolate Viscosity Reduced by Addition of 1 Percent Methylated Cephalin—Percy L. Julian, Maywood; Edwin W. Meyer, Evanston, and Herbert T. Iveson, Chicago, Ill., to American Lecithin Co., Cleveland, Ohio. No. 2,373,687. April 17, 1945.

Thickening and Congealing Agent Made to Consist of Dry Powdered Mixture of Pectin, Pectase and Water-soluble Salt of Polyvalent Metal—John J. Willaman, Plymouth Meeting, Pa., to Secretary of Agriculture of U. S. A. No. 2,-373,729. April 17, 1945.

Dry Granular Food Product Made to Contain Rendered Animal Fat Mixed With Edible Finely Ground Material of Substantial Absorbent Capacity—Fred H. Barker, Los Angeles, Calif. No. 2,-373,805. April 17, 1945.

Sausage Stuffed Into Casing and Similar Container At Substantially Constant Pressure and In Continuous Manner—Charles T. Walter, to Industrial Patents Corp., Chicago, Ill. No. 2,-373,865. April 17, 1945.

Sugar Product Made to Consist of Sucrose Crystals Intergrown With and Isolated by Dextrose Crystals—Mitchell F. Schweiger, Berkeley, Calif., to J. D. & A. B. Spreckles Co., San Francisco, Calif. No. 2,373,919. April 17, 1945.

Fruit and Like Intended for Pickling Sliced and Cut Mechanically on Continuous-Operation Basis—Archie Paradis, South Paris, Me. No. 2,373,973. April 17, 1945.

Tuna Fish Prepared for Canning by Removal of All Dark Meat and Larger Bones—Kristian Wuori and Gearhart K. Wuori, Astoria, Ore. No. 2,373,988. April 17, 1945.

Fresh Whole Fruit Cleaned and Sterilized Against Decay by Washing in Solution of Water-soluble Salt of Hydroxy Diphenyl and Tetra-sodium Pyrophosphate With pH Greater Than 10—Arthur F. Kalmar, Riverside, Calif., to Food Machinery Corp., San Jose, Calif. No. 2,374,209. April 24, 1945.

Fresh Whole Fruit Protected Against Decay by Treating With Aqueous Solution of Hypochlorite of Alkali-forming Metal Followed by Treatment With Aqueous Solution Containing Reducing Agent and Water-soluble Salt of Hydroxy Diphenyl With pH Above 10—Arthur F. Kalmar, Riverside, Calif., to Food Machinery Corp., San Jose, Calif. No. 2,374,210. April 24, 1945.

Canadian Patents

Green Coffee Frozen to Reduce Moisture Content, Subjected to Steam Vapors to Increase Surface Moisture and Irradiated With Ultra-violet for Over 2 Minutes—Daniel Joseph Kennedy, Vancouver, British Columbia. No. 426,467. April 3, 1945.

Coffee-like Cereal Product Made to Consist of 6 Parts Flour, 2 Parts Yeast Containing Small Quantity of Hops, 1.2 Parts Malt, 0.8 Parts Soya Flour and Sufficient Water to Make Dough-like Mass Which May Be Shredded, Dried, Roasted and Ground—Bert West, Toronto, Ontario. No. 426,479. April 3, 1945.

Wheat Germ Recovered From Flour After Pass Through Third Break Roller Mill—Joseph Flawith Lockwood to Henry Simon, Ltd., Cheadle Heath, County of Chester, England. No. 426,-571. April 3, 1945.

Packs of Casingless Sausages of Predetermined Weight and Uniform Length Formed by Automatic Mechanical Means—William Muir Yuill, Edinburgh, Scotland. No. 426,661. April 10, 1945.

Cream Concentrated to 85-95 Percent Milk Fat Content by Centrifugal Separation and Emulsified With Inclusion of Salt and Starter to Make Butter—Herman C. Horneman, Ralph V. V. Hussong and Sidney N. Quam, Danville, Ill., and Bernard W. Hammer, Ames, Iowa, to Sugar Creek Creamery Co. No. 426,748. April 10, 1945.

Dough Fed Continuously From Feed Hopper Through Sheeter to Dough Brake Consisting of Rolls and Tiltable Table in Series With Biscuit Cutting Machine Gage Rolls—George Donald Wilson and John Hart, to Baker Perkins, Ltd., Peterborough, Northamptonshire, England. No. 426,833. April 17, 1945.

FOOD TECHNOLOGY

NEW DISCOVERIES AND INVENTIONS

FATS AND OILS

Laboratory Test Will Identify Shortenings

ARACHIDONIC ACID is present in lard and not in hydrogenated vegetable oils. With shortenings containing 50 per cent or more of lard there are well-defined maxima in the absorption spectrum at 3010 and 3160A, when the alkali isomerized soap is subjected to spectrophotometric examination in the range from 2900 to 3200 A.

The amount of the tetraethenoid acid in the animal fats varies so that quantitative chemical tests for it will not determine the proportion of lard in the lard-vegetable fat mixtures.

Digest from "A Spectrophotometric Method for Differentiating Between Lard and Hydrogenated Vegetable Oils," by B. W. Beadle, H. R. Kraybill and L. A. Stricker, Oil & Soap, vol. 22, 50-51, February, 1945.

Edible Linseed Oil

ITALIAN work on production of edible plastic fat from linseed oil confirms the belief that the process is possible, but is of interest only when edible fats are scarce. The Italian workers used a nickel catalyst, at a temperature of 175 to 210 deg. C. The fat could be used directly in making biscuits or emulsified into a butter-like material. But the process is not economical since the linseed oil must be freed of phosphatides, more than double the usual amount of Ni catalyst is required, the operating time is longer and the hydrogen consumption is greater than for other oils.

Digest from "Edible Products by Hardening Linseed Oil," by A. D. dalle Rose, Ricerca scientifica, vol. 9, 38-41, 1943, through Chemical Abstracts, vol. 38, 6,000, November 10, 1944.

NDGA and Lard

INDIVIDUAL components of lard were studied for oxidation behavior and the effect of antioxidants. The exact components are not available but they are represented approximately by methyl oleate, methyl stearate and methyl linoleate. These, singly and in combination, together with the distilled methyl esters of lard, were tested in the Barcroft-Warburg apparatus at 100 deg. C. Methyl linoleate was added for comparison.

Effect of Antioxidants and Synergists on Oxygen Absorption of Methyl Esters of Fat Acids.

Concentration, 0.01 percent; temperature, 100 deg. C.; stability expressed as time required to absorb 1 g. of O_2 per kilogram

Antioxidant	Methyl linoleate (minutes)	Methyl oleate (hours)	Distilled methyl esters of lard (hours)
NDGA plus citric acid	210	135.0	31.3
Propyl gallate plus citric acid	158	101.0	25.4
NDGA*	141	43.5	9.5
Propyl gallate	96	34.2	8.7
Benzylhydroquinone plus citric acid	126	22.5	5.2
α-tocopherol plus citric acid	67	35.0	8.5
α-tocopherol, soya lecithin, d-isoascorbyl palmitate**	78	36.0	4.5
Benzylhydroquinone	85	13.0	3.0
α-tocopherol	41	8.5	3.5
None	11	2	1

*Nordihydroguaiaretic acid. **Concentration 0.02 percent.

In the tests on mixtures, the absorption of oxygen was close to that which could be predicted from the values for the components. Iodine number alone does not determine the rate of oxidation. A 50-50 mixture of methyl linoleate and methyl stearate has about the same iodine number as methyl oleate, yet absorbed oxygen much more rapidly. Methyl stearate, with an iodine number of 0, absorbed oxygen and formed peroxides.

Stability, expressed as time required to absorb 1 g. of oxygen per kilogram, is shown for the linoleate, oleate and the lard esters. Methyl stearate with antioxidants did not give sufficiently reproducible results to warrant its inclusion in the table.

Digest from "Oxygen Absorption of Methyl Esters of Fat Acids, and the Effect of Antioxidants," by A. J. Stirton, J. Turer and R. W. Riemenschneider, Oil and Soap, vol. 22, 81-83, April, 1945.

BAKING

Sugar Saver

LACTOSE can be fermented in bakery doughs containing milk products, so as to add a leavening effect to that achieved in the usual way with baker's yeast and sucrose or malt sirup, according to one of the patents issued recently.

When the lactose-fermenting yeast, *Torula cremoris*, was added in equal amounts to baker's yeast, 25 to 40 percent more gas was produced in a dough without increase of its fermenting sugar content in one test recited in the disclosure.

The claims are restricted to a dough in which there is insufficient sugar other than the lactose contained in the milk to produce adequate leavening.

Digest of U. S. Patent 2,367,994, issued January 23, 1945, on an application filed July 26, 1943, by H. H. Browne, Arlington, Va., and dedicated to the free use of the People in the territory of the United States.

FREEZING

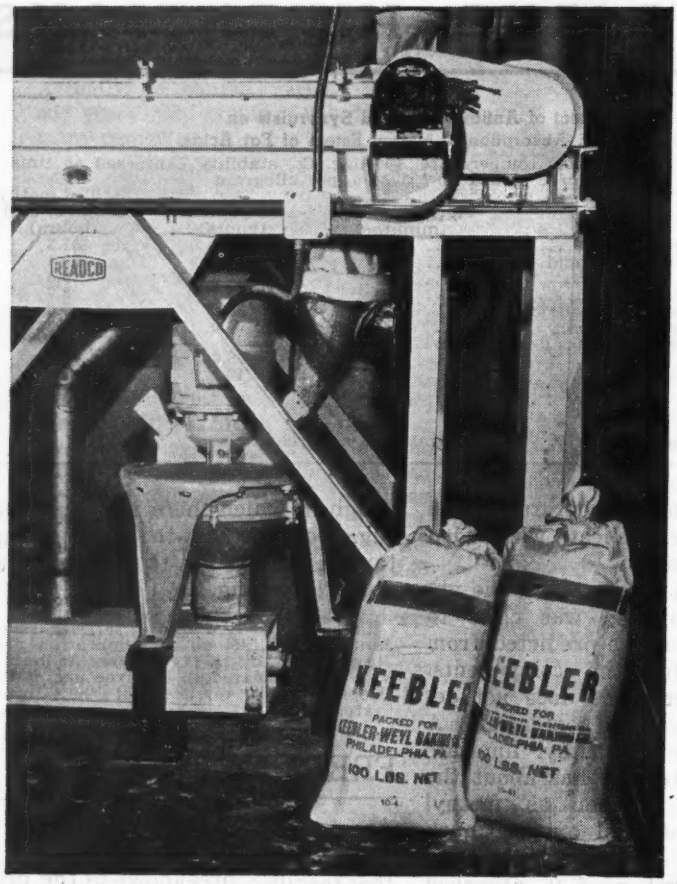
Denaturation in Fish

IRREVERSIBLE breakdown of the protein constituents, generally designated as denaturation, occurs not only through heat but during the freezing of substances such as fish. Whether brought about by heating or freezing, the reaction appears to take place chiefly while the nitrogenous material is in contact with or dissolved in the liquid naturally present in the flesh.

In freezing, rupture of the cell walls through formation of large ice crystals releases the juices, or "drip." Rapid freezing, then, is doubly important, to prevent formation of damaging crystals and to minimize time of contact of the nitrogenous substances with this juice while it is liquid. Recent experiments indicate that although freezing starts only a little below 0 deg. F., both the raw flesh and the extracted juice contain appreciable quantities of liquid at temperatures well below 0 deg. F.

Use of a sensitive dilatometer will permit the investigator to follow the freezing within a fish sample as the temperature is lowered. Flounder was selected as experimental material to avoid the complications introduced by the oil in more oily fish.

"ENTOLETER" PROTECTS QUALITY STANDARDS



"ENTOLETER" is installed under sifter in this modern bakery installation. The machine offers 100% protection to free-flowing dry materials such as flour, meal, mixes, powdered soups, sugar, spices, etc. Models available in various capacities to meet requirements.

You Profit from This Proved Insect Destroyer

All forms of insect life are destroyed by the mechanical "ENTOLETER", from microscopic eggs to fully developed adults. Many food processors are extending "ENTOLETER" applications in their plants due to proved results from their first installations. Get the facts on "ENTOLETER" performance. Latest bulletin shows amazing low cost of multiple installations. Write for it today. Entoleter Division, The Safety Car Heating & Lighting Company, Inc., P. O. Box 904, New Haven 4, Conn.

"BUGS" BEETLE SAYS . .

"There was a time when an up and comin' bug could find free board and lodgin' in any likely spot. Now we have to be on the watch for "ENTOLETERS."

ENTOLETER
INFESTATION DESTROYER
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CONTINUOUS DESTRUCTION OF ALL INSECT LIFE

The most rapid freezing occurred between 32 and 23 deg. F. When the latter temperature was reached, 80 percent of the amount of liquid finally frozen had solidified. At 0 deg. F., 95 percent had frozen. But at –30 deg. F., the lowest temperature to which this test was carried, some freezing was still taking place.

In practical terms, the Board recommends that fish freezing be done at a temperature such that the center of the thickest part reaches 23 deg. F. within an hour.

Digest from "The Complete Freezing of Fish Flesh," by P. J. Frost and N. M. Carter, Progress Reports of the Pacific Coast Stations, Fisheries Research Board of Canada, No. 62, 21-23, March, 1945.

ENGINEERING

Acid Powder Retains Vitamin C

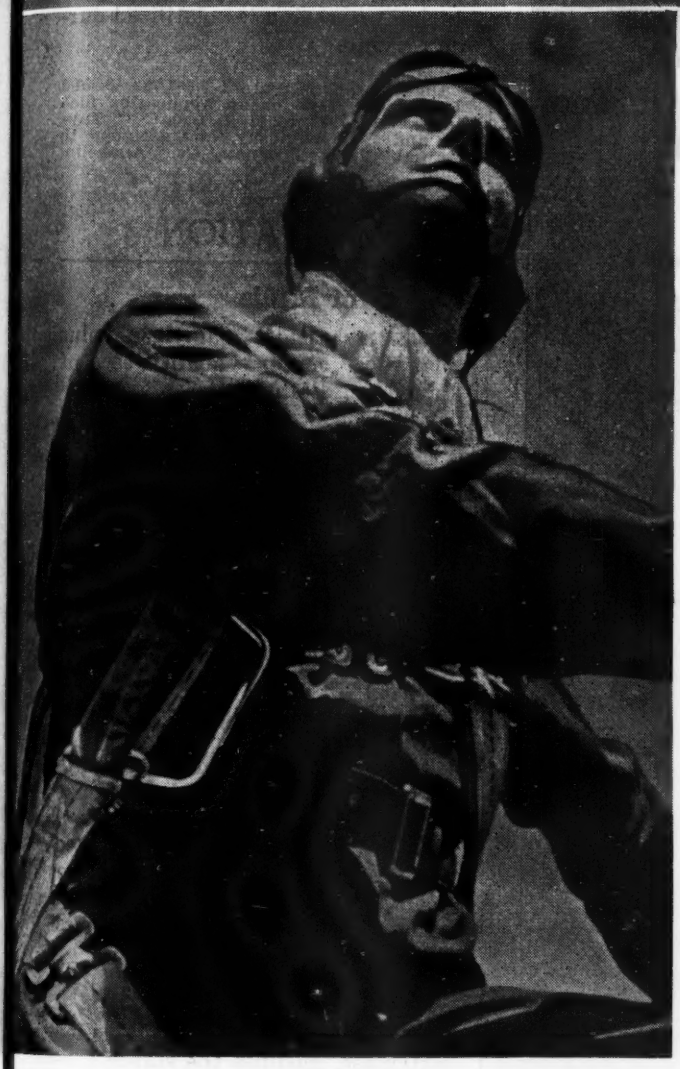
CITRIC ACID made from lemons or other citrus fruits will retain the natural ascorbic acid of the fruit when made by a process on which a patent has been issued recently.

The product is a powdery mixture of corn sirup solids and lemon juice solids, without strong lemon flavor and devoid of active bacteria, enzymes, oxidases and other undesirable constituents. It is easily soluble in cold water to yield a clear solution suitable for carbonated beverages. The powder can also be used in flavored and sweetened mixes for gelatine desserts.

The fruit is reamed so as to avoid lemon oil and bitter juice. Large fruit sacs are removed by a revolving stainless steel screen. Sodium bisulphite, 1 oz. for each 100 gal. of juice, is added to prevent oxidation of the ascorbic acid while heating quickly to 190 to 212 deg. F. to destroy bacteria and oxidizing enzymes.

The sterilized sirup must be cooled quickly below 150 deg. F. Dextrinized glucose at about 35 to 40 deg. F. is added to each 70 gal. of juice and, if necessary to produce a standardized product of the correct acidity, concentrated sterile lemon juice may be added. Again sodium bisulphite is added, 1 oz. per 100 gal., to prevent oxidation during filtering. To clarify, the sirup is brought to 140 to 170 deg. F. in a heat exchanger, natural diatomaceous earth is added, the mixture is put through a filter press and cooled promptly to below 100 deg. F. Precautions are necessary to prevent the darkening and chemical change in the sirup that will occur if it is allowed to remain

He's more fit to serve his country than the youth of any previous war!



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Fleischmann's Yeast Extract and Liver

Yet **nutritionists are agreed that there is still much to do in improving diets and building the nation's health.**

Selectees of this war are taller on the average, better developed physically, have fewer serious impairments, than the selectees of 1917-18.

These are facts established by wartime medical examinations.

Reasons for this better state of health are not hard to find: young men of draft ages grew up at a time when organized efforts to improve child health were on the upswing; *more* youngsters benefited from good nutrition and better environmental conditions.

That is the cheerful aspect of the health picture. It is, however, not the full picture.

Nutritionists know, for instance, that many thousands of young men were rejected for the armed services because of physical impairments directly traceable to faulty diets.

They know that, among the American population as a whole, *more than half of the families are not getting satisfactory diets.*

Yes . . . there is much still to be done. And you, as a nutritionist, have given considerable thought to the problem.

Your company may already have considered starting nutritional studies or it may have them under way. If so, perhaps Standard Brands Incorporated can be of help. We have spent considerable time on research in recent years developing vitamin yeast products and yeast derivatives for food fortification. These experiences we will gladly share with our customers.

So if you are seeking ways of enriching your company's products, write us. One of our executives will be glad to discuss your problem with you in complete confidence. It's a service we are glad to render.

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warm or if sterilization after filtering is attempted.

The sirup should test above 30 deg. Brix before spray drying or the resultant powder will be too fluffy and finely divided for convenient handling. Moisture in the product should be below 1 percent.

The sulphur dioxide generated during processing is volatilized during drying.

Digest of U. S. Patent 2,367,789, issued January 23, 1945, on an application filed January 19, 1942, by H. T. Leo. C. C. Taylor and J. W. Lindsay, and assigned to Mutual Citrus Products Co., Anaheim, Calif.

FERMENTATION

Sorghum Malts

SORGHUM yields α-amylase plus relatively minor quantities of β-amylase. Both amylases are similar in properties to the corresponding fractions from barley.

The α-amylase has the same optimum pH ranges for activity and stability, a similar relationship between starch liquefying and dextrinizing activities, and lack of efficiency in conversion of starch to fermentable sugars. It shows a lower production of reducing groups per units of α-dextrinizing activity in the initial stages of starch conversion.

The β form is present in amounts too minute to be recorded by the customary methods of evaluation, but sufficient is present to influence significantly the post-dextrinization saccharification of starch. A level of conversion to fermentable sugars approaching that brought about by barley malt is obtained by prolonged action.

A third factor, tentatively called dextrinase, modifies the starch conversion and may be influential in splitting dextrins to fermentable sugars.

Digest from "Sorghum Amylase," by E. Kneen, Cereal Chemistry, vol. 22, 112-34, March, 1945.

RESEARCH METHODS

A Better Microscope For Dairy Research

PROBLEMS that should be investigated and may be solved through the increased resolving power of the electron microscope are listed.

Suggested problems include those concerned with the fat, those involving microorganisms and miscellaneous matters dealing with crystal structure. Among the first group are the nature of the butter-

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To put it another way, Betner service is complete, "from idea to finished bag." Not just bag-making, though we make them by the billion every year. But ideas, designs, art suggestions, packaging advice — Betner's complete service includes them all.

As the picture above so subtly hints, every packaging angle covered. And it's a service you can employ *all or part.*

Famous brands galore go to market under the protection of Betner Bags. Frozen foods, powdered and dehydrated foods, coffee, cereals, flour mixes, many others — they're all "Betner-bagged" for easy filling and sealing, for insurance against leakage, seepage, loss of bulk or flavor.

We've helped a lot of processors with their packaging perplexities; perhaps we can do as much for you. Remember, Betner service is at your service, all or part. Ask us more about it; you won't be obligated in any way.

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The Superintendent responsible for plant sanitation and maintenance cleaning operations in your plant will "pick up" many valuable pointers on handling such jobs as: cleaning, derusting, descaling and related operations. We believe he will find much that is interesting in those sections devoted to the important subject of safeguarding quality control with modern Oakite germicidal materials and methods.

The comprehensive Oakite Digests described below include a wealth of tips, *tested* techniques to help put your sanitation routines on an *easier, faster,* more *effective* basis with Oakite cleaning and germicidal materials.

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MEAT PACKERS DIGEST . . . Over 58 various recurring sanitation and maintenance jobs on which low-cost Oakite methods and materials can be used to help speed-up and simplify daily clean-up work.

QUICK FREEZE & LOCKER PLANTS . . . Expressly prepared for operators of quick freeze, dehydrating and locker plants, this Oakite Sanitation Digest gives many valuable, time-saving tips on daily clean-up of processing and handling equipment. A special section is devoted to germicidal treatment of equipment surfaces.

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fat globule and the globule membrane; coalescence of fat globules clumping, heat penetration and chilling, cream rising, apparent and real viscosity, stiffening of whipped cream; physical and chemical emulsification, homogenization, sonic vibration. Changes in the structure of butterfat globules and of protein molecules should be followed by this means, as should dispersion of lipase and oxidase enzymes.

Direct observation of the effect of ultraviolet, infrared and heat rays on individual bacterial cells and determination of the corresponding death-point is believed possible.

Also suggested are the study of microcrystallization through quick freezing, detection of traces of foreign metals and checking the smoothness of dairy equipment surfaces.

Digest from "The Electron Microscope and Dairy Industry Research," by A. Moldavan, Canadian Dairy and Ice Cream Journal, vol. 24, February, 1945.

CEREAL PRODUCTS

Flour Absorption

Results are given of tests on 1[illegible] pure hard winter wheat varieties from widely different environments to demonstrate the application of methods used in government co-operative wheat studies to evaluate absorption.

The relationship of protein to absorption is linear within any one variety, although the slopes of the lines vary from variety to variety. The relationship remains valid from season to season. When the protein-absorption curve has once been established it can be used to estimate absorption for other samples of that variety if protein and moisture contents are known.

The curves are determined by estimating the most desirable water content for standard doughs varying 2 percent in water, fermented under standard conditions for [illegible] hours. Absorption determinations can be checked from day to day within limits of 0.5 percent.

Variations of 2 percent plus or minus the optimum water content of a bread dough do not significantly alter loaf volumes or grain-texture scores. A decrease of [illegible] percent has a significant effect on loaf volume and sometimes on grain-texture.

Digest from "Methods of Estimating and the Effect of Variety and Protein Level on the Baking Absorption of Flour," by K. F. Finney, Cereal Chemistry, vol. 22, 149-58, March, 1945.

FORMULAS FOR FOODS

FORMULA NO. 536

Crumb Cookie Mix

Cake flour	5 lb.
Cake crumbs	5 lb.
Dark brown sugar	1 lb. 4 oz.
Dextrose	2 lb. 8 oz.
Molasses	1 lb. 4 oz.
Shortening, (hydrogenated)	1 lb. 4 oz.
Salt	1¼ oz.
Cinnamon	1 oz.
Allspice	⅛ oz.
Cream of tartar	⅛ oz.
Baking powder	6 oz.
Dry skim milk	5 oz.
Baking soda	¼ oz.

Directions

Before making the cake crumbs, trim the cakes of all icing. Weigh and allow this as part of the sugar weight. After weighing, replace with the dried cake and mill with the crumbs. Sift so as to insure fine granulation. Sweet yeast goods, as well as other types of cake, may be used.

Put the molasses into the mixer bowl, add the cream of tartar and stir to incorporate. Next blend into this the shortening, after which add the dry ingredients, all except the crumbs, after mixing them together thoroughly. When the blend is smooth, sift again and add the crumbs. Mix well to incorporate.

To make up, use 1 egg and ½ cup of water to 1 lb of the mix. Mix the egg and water, add this to the mix and stir well until smooth.

These may be deposited or dropped and smoothed flat with a spatula dipped in liquid milk. If placed in the refrigerator for several hours, the dough will be of a good consistency for rolling and cutting.

These cookies have a good spread and bake crisp and dry.

Bake at 400 deg. F.

Formula from Laura K. Track.

FORMULA NO. 537

Creole Marshmallow

Refined sugar	60 lb.
High-grade molasses	15 lb.
Corn sirup	30 lb.
Gelatine	2 lb. 8 oz.
Water	25 lb.
Roman punch or vanilla flavor	as desired

Directions

Mix the gelatine with 10 lb. of cold water and set aside for at least one-half hour. Place the remaining 15 lb. of water in a clean kettle, add the sugar and heat until dissolved.

Turn off the heat, add the molasses and corn sirup, then add the soaked gelatine. Mix until the gelatine is completely dissolved.

Place the batch in a marshmallow beater and beat until quite light.

Add the flavor, mixing well, then cast into clean starch which has been tempered to approximately 95 to 100 deg. F. Allow to remain at normal room temperature for approximately 12 hours, in order to set.

When removed from the starch, dust with a powder made up with 10 lb. of dry cornstarch and 90 lb. of powdered sugar.

The marshmallow should remain in the dusting material for approximately 3 hours before packing the product.

Formula from The Nulomoline Co.

FORMULA NO. 538

Soya Pie Dough

Pastry flour	100 lb.
Shortening	50 lb. 10 oz.
Water	48 lb. 12 oz.
Salt	3 lb. 8 oz.
Full fat soya flour	5 lb.
Enzyme-converted corn sirup	3 lb.

Directions

Suspend the soya flour, corn sirup and salt in water. Add to the blended flour and shortening. Mix only long enough to take up the dry particles.

This can be used at once or stored in a cool place until needed.

More or less shortening may be used, as desired. The water must be regulated so that the dough will handle properly. The dough temperature should be kept around 60 deg. F. In hot weather, this may require the use of ice water and also the use of refrigerated shortening and flour.

Three types of dough—mealy, short-flake and long-flake—may be made from this formula merely by varying the extent to which the shortening is mixed into the flour and making the necessary adjustments in the moistener. Less water will produce a mealy crust, while more water will produce one that is flaky.

Formula from A. E. Staley Mfg. Co.

FORMULA NO. 539

Butterscotch Cream Pie

Brown sugar	2 lb.
Enzyme-converted corn sirup	1 lb. 8 oz.
Butter	6 oz.
Water	8 lb.
Low-fat soya flour	1 lb. 4 oz.
Bakers' starch	7 oz.
Vanilla	½ oz.
Egg white meringue (optional)	8 oz.

Directions

Cook the brown sugar, corn sirup and butter together slowly to develop the flavor and color. Stir constantly. Slowly add 6 lb. of water and the soya flour. Bring to a boil.

Suspend the special bakers' starch in water (2-lb.), add to the batch and cook thoroughly. Remove from the heat and add the vanilla, then fold the meringue into the hot cream.

Fill into prebaked shells at once or allow to cool slightly before filling. When cool, top pies with meringue and brown in the oven.

This is a suggested formula. Variations include an increase of the special bakers starch to 8 or 9 oz., or the addition of 2 lb. more of meringue to produce a chiffon pie.

Formula from A. E. Staley Mfg. Co.

FORMULA NO. 540

Cereal Pancake Mix

Flour	10 lb.
Soya flour	3 lb. 5 oz.
Whole wheat cereal	2 lb. 3 oz.
Yellow cornmeal	2 lb. 3 oz.
Wheat germ	2 lb. 3 oz.
Soya milk powder	2 lb. 3 oz.
Dark brown sugar	2 lb. 2 oz.
Corn sugar (anhydrous)	9 oz.
Salt	7 oz.
Soda	4 oz.
Cream of tartar or substitute	7 oz.

Directions

Sift the salt, soda and cream of tartar or substitute with the soya flour, sifting as many as 4 times if necessary to get a thorough mix. Sift the brown sugar through 3 lb. of the white flour, then sift with the remainder of the flour. Blend this and the cereals in a mixing machine for about 12 minutes.

To make up, use about 1¾ cup water and 1 egg to 8 oz. of mix. With some flours, more water may be needed. Allow to stand for ¼ to 1 hour before using.

Formula from Laura K. Track.

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This very smooth, light density (semi-fluid) grease type lubricant resists water and other unfavorable operating conditions to a marked degree. LUBRIPLATE No. 105 not only provides superior lubrication but offers utmost protection against rust and corrosion. Because of its waterproof feature and freedom from "drag", it is ideal for

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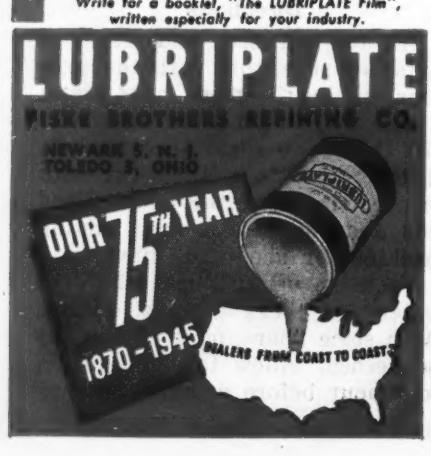

What Technology Means to the Packer

(*Continued from page* 100)

tained entirely in their essential oils and oleo resins. These emulsions were used for some time and then were superseded by another type of spice in which these essential oils and oleo resins were mixed with corn sugar. This mixture proved a distinct advantage from the standpoint that the flavor in this so-called "dry spice" was more available than the flavor of the spice itself. Some of the packers undertook to manufacture their own dry spices and have been very successful in this direction.

Nutrition Studies

We have not mentioned the subject of nutrition, but this is an aspect of technology that is continually before the packers' scientists.

Much work has been done within the industry itself and through fellowships in well-known universities to determine the nutritive value of meat, the presence of vitamins, and losses which may be sustained in various types of cooking or canning meat products. There is still a large field before us in the study of this particular subject.

Piloting Progress

Another phase of research and technology is pilot-plant operation. Before a process developed in the research laboratory is put into plant practice, it is first worked out in pilot plants which are large enough to handle products on a semi-commercial basis. Among such experimental units are those given over to oil and fat refining, meat curing, sausage making, baking and chemicals manufacture in which work on fatty acids is carried on.

In a paper of this kind, it is difficult to cover all of the field in which the food technologist functions in the meat packing industry. A great deal of work is being done on the subject of canned meats, the manufacture of margarine, the proper preservation of hides, the utilization of hair, the application of temperature control and improved methods of handling materials and meats into and through the plants.

Trend to Technologists

In this discussion we have endeavored to convey some idea of

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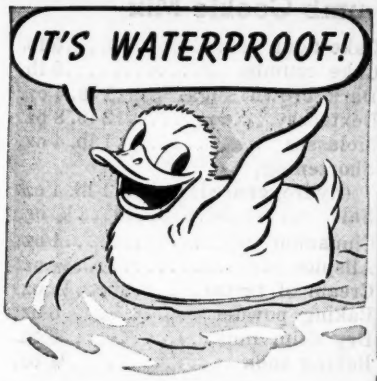

Industry, especially food packers, have long required a waterproof lubricant that was clean and easy to apply. LUBRIPLATE No. 107 is the answer. It is a general purpose lubricant, white in color and just the right density for application by pressure guns or grease cups. LUBRIPLATE No. 107, like other LUBRIPLATE products, arrests progressive wear, saves power, and protects machines against rust and corrosion. It will pay you to try LUBRIPLATE and see how it will cut down repairs.

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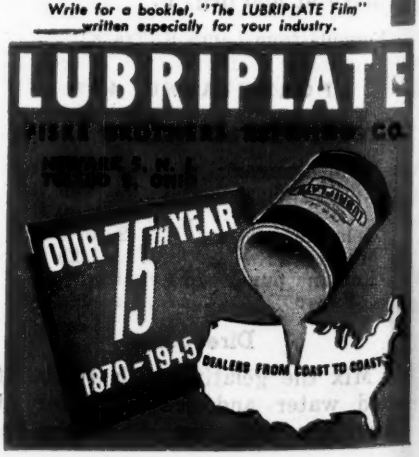

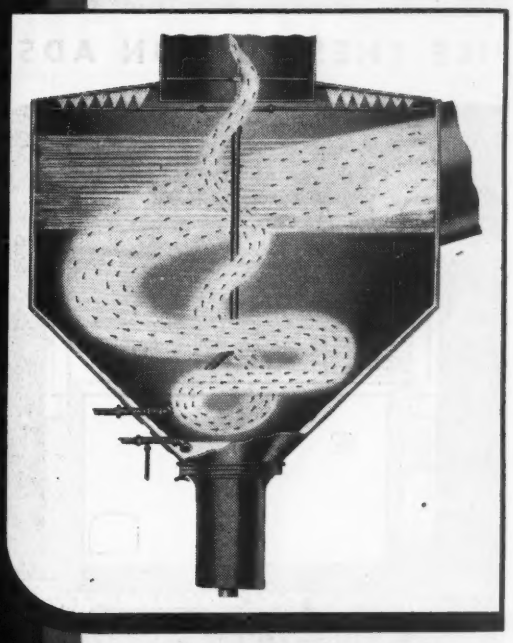

Above is a diagrammatic view of the Liquid Collector used in the Douthitt Gray-Jensen Process. It eliminates the use of bags, yet thoroughly prevents the escape of solids entrained in the air stream.

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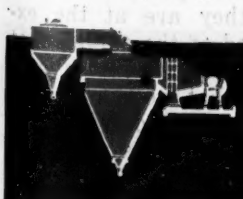

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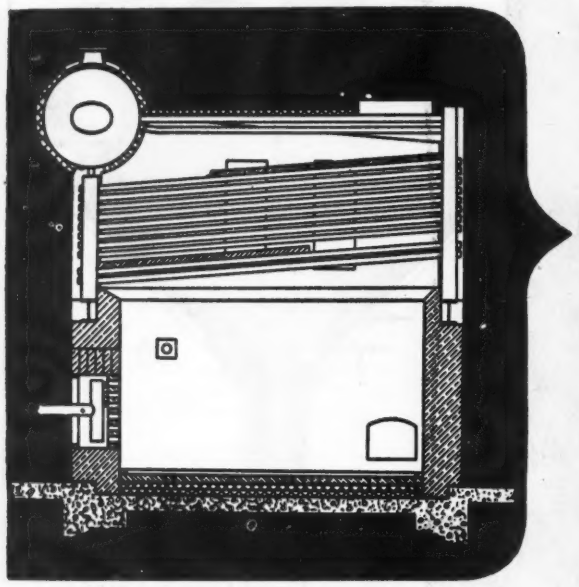

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the changes which have occurred in the industry since the food technologist became a part of it 50 or more years ago. We would not presume to claim that all of the improvements and changes which have been effected are due to the efforts of the technologist. There have been many non-technical operating men who have had a leading part in these developments. However, as many of the operations of the packing industry are of a technical nature, the trend during the late years has been to place chemists, chemical engineers and bacteriologists in responsible positions in the operating departments, and we expect that practice to be carried on to a much greater extent during the postwar period.

Psychometrics— Quantity Control Tool?

(*Continued from page* 75)

alogy between panel selection and calibration of scientific apparatus. In both cases, it is necessary to know the sensitivity and validity that is required and can be expected. In the case of scientific apparatus, reproducibility of results is assumed in the absence of changing conditions. However, in the case of a psychometric panel, where human subjects are involved, reproducibility cannot be assumed. Rather, it must be recognized that at irregular intervals emotional or other factors may affect the ability of a particular subject to furnish reproducible measurements. For this reason, it is not entirely safe to rely on a one- or two-subject panel. However, it is recognized that investigations may be designed to provide adequate control samples so that the measurements obtained from even a single individual can be statistically significant.

It is known that individuals vary widely with respect to the three criteria just discussed. As is true in many other instances, the sensory sensitivity of populations corresponds to the expected normality curve. It is the objective usually, but not necessarily in psychometric panel selection, to use only those individuals whose performance indicates that they are at the extreme right end of the curve—that is, the most sensitive. It is only by calibration that we can be sure that individuals with only medium or poor sensitivity for a particular factor are not being included on a psychometric panel.

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A heat-sealing medium on the foil permits making the seams and opening of this clever standup envelope airtight and moisture-vaporproof. In such a package, products as highly moisture-sensitive as gelatin desserts, puddings, pectin and whole milk powder can be marketed safely.

This is one of scores of new ideas for using Alcoa Aluminum Foil that are buzzing around in the design and testing stages today. Among designers, suppliers and users of packages, interest in aluminum foil is greater than it has ever been because war packaging applications have so conclusively proved its superior protective properties.

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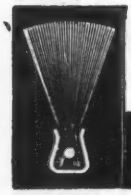

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The sensitivities given in Table I have been recorded in the literature.

TABLE I—Sensitivities for Particular Factors.

Odor	
Chlorophenol	0.4×10^{-3} mg./l
Ionone	0.1×10^{-6} to 0.5×10^{-7} mg./l
Artificial musk	0.4×10^{-7} to 0.5×10^{-8} mg./l
Vanillin	0.5×10^{-6} to 0.2×10^{-9} mg./l
Taste	
Sugar (cane)	7.000 mg.
Salt	1.500 mg.
Tartaric acid	0.200 mg.
Caffeine	0.040 mg.
Quinine	0.016 mg.
Saccharine	0.012 mg.
Particle size	1/2500 to 1/25000 in.
Thickness of skins	1/1000 to 1/2000 in.
Body of solutions (viscosity)	
Sodium chloride	0.93 molar weight
Manganese sulphate	0.42 molar weight
Glycerine	0.65 molar weight
Cane sugar	0.18 molar weight

It is important that the product under examination be conducted under standardized conditions usually unique for the particular type of product. For example, it is desirable that the sample be brought to an optimum temperature, that an optimum quantity be employed, and that the time interval between examinations be optimum and constant. The environment in which the examination is being conducted should be optimum with respect to lighting, temperature, humidity, comfort and time of day. Freedom from distraction is essential, particularly with reference to discussion between panel members.

The Subsistence Research & Development Laboratory has recently been authorized to construct a unit that provides optimum environmental conditions for food acceptance research investigations. This broad program will be under the direction of Dr. W. Franklin Dove.

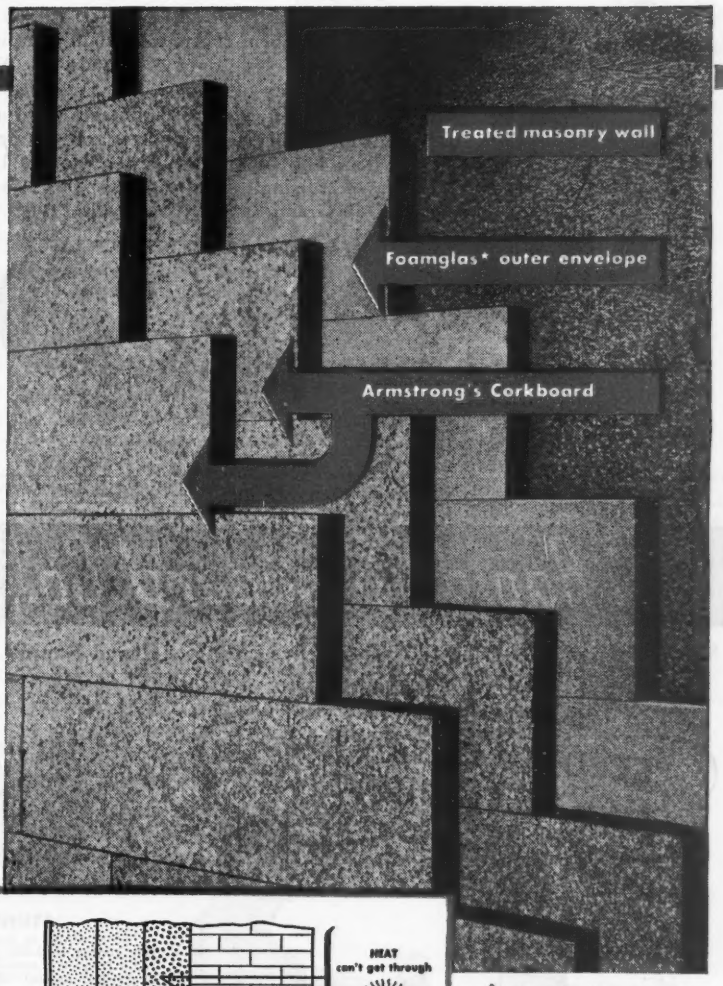
It is important to recognize that "psychometrics" as discussed in this paper refers to a scientific discipline in a manner that is all too frequently not true of current practices in many research institutions and food industry laboratories. Attention is specifically invited to the following two facts:

1. *It is not the purpose or objective of psychometrics to determine or estimate likes, dislikes, acceptability or palatability. Rather, it is only interested in determining sensory differences.*

2. *Human subjects with a known food sensory measurement history are utilized.*

This is in contrast to the use of individuals or panels that have not been trained, that have not been calibrated and that may or may not be sensitive. When individuals are selected at random, or on the basis of being the investigators on the particular overall research

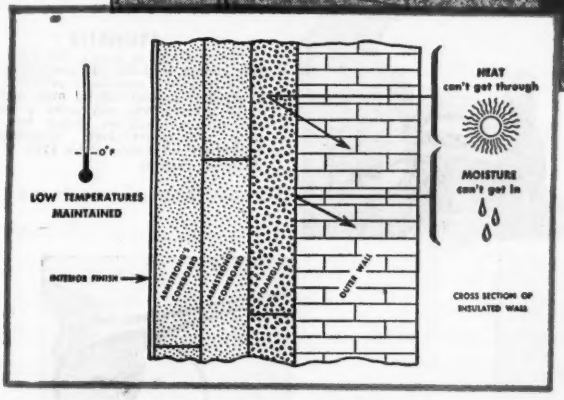
This new way to insulate freezers PERMANENTLY STOPS MOISTURE



NOT ONLY for quick-freezing, but for sub-zero holding of frozen foods, more and more refrigerated space is being insulated to operate economically under severe conditions. Recently the Merchants' Terminal Corp. of Baltimore reinsulated a large part of its giant warehouse to maintain 20° F. below zero. To make sure of high insulation efficiency as well as a permanent vapor barrier, the owners selected Armstrong's new combination construction.

This construction combines Armstrong's Corkboard and Foamglas* and takes full advantage of the unique properties of both materials. The Corkboard provides maximum economical insulating efficiency and high natural moisture resistance. The outer shell of Foamglas is not only good insulation, but also provides a positive, permanent vapor seal. Foamglas is the cellular form of glass which is absolutely impervious to moisture, vapor, and air. It is also fireproof and has high structural strength.

Refrigerated space that must operate under severe conditions—excessive moisture, wide temperature differentials, and high vapor pressure differentials—can use this new combination construction to advantage. For complete details, including engineering drawings and erection specifications, write today to Armstrong Cork Company, Building Materials Division, 4206 Concord Street, Lancaster, Pennsylvania.



▲ Combination construction (above) for Merchants' Terminal Corp., Baltimore, erected by Armstrong's Contract Service. Interior finishes are the same as those used in standard corkboard installations.

◀ Diagram (left) shows how Armstrong's new combination construction bars heat and moisture.

* Reg. U. S. Pat. Off. Product Mfg. by Pittsburgh Corning Corp.

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Complete Contract Service For All Temperatures

From 300° Below Zero

To 2600° Fahrenheit

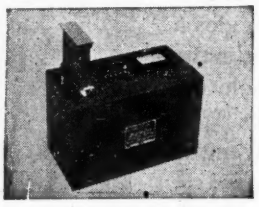
EASY WHEELING WITH THE *WHEEL-EZY*

For easier handling of heavy cases and kegs the Rapids-Standard Wheel-Ezy truck will save you time, labor and expense. Arc-welded in one-piece construction and weighing only 29 pounds, the Wheel-Ezy has a load capacity of 500 pounds. Equipped with the new air wheel with large demountable cushion-type roller-bearing rubber tires mounted on strong, light magnesium hub of aircraft design, double handle model is $14.25, single handle model is $13.25, both prices F.O.B. Grand Rapids. Other wheel types are available.

Manufacturers of
STEEL FORGED CASTERS - TRUCKS - CONVEYORS - POWER BOOSTERS

The Rapids-Standard Co., Inc.

Sales Division, 361 Peoples National Bank Bldg. Grand Rapids 2, Michigan



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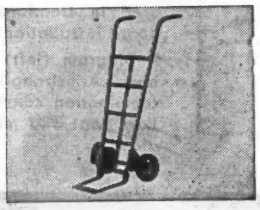
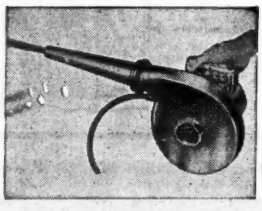


TUBULAR STEEL BAG TRUCK

65AR—7" diameter wheels, rubber tires, roller bearings. Frame of tubular steel, all joints welded. 9 inch nose. Handle 48 inches in length. Price $22.00. Other sizes available.



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634 BROOKS BUILDING **CHICAGO 6, ILLINOIS**

SEEDBURO EQUIPMENT COMPANY

project, or because they are department heads or company executives, it is believed that it is not possible to arrive at sound conclusions.

Cutting Costs With Volts

(*Continued from page* 93)

tors. Therefore, when comparing 440-volt motors to motors operating directly at primary voltage (i.e., 2,400 or 4,160 volts), the installed price of a step-down substation must be included with the 440-volt motors and control. This substation is included at $4 per horsepower. Since branch circuits to 440-volt motors usually require larger cables than do 2,300- or 4,000-volt motors, 50 cents per horsepower was included in Curve A to cover the cost of the larger 440-volt cables. The cost of the low-voltage motors, control, and the step-down unit substation is plotted as a function of motor horsepower rating in Curve A, Fig. 1.

Motors on Primary Voltage

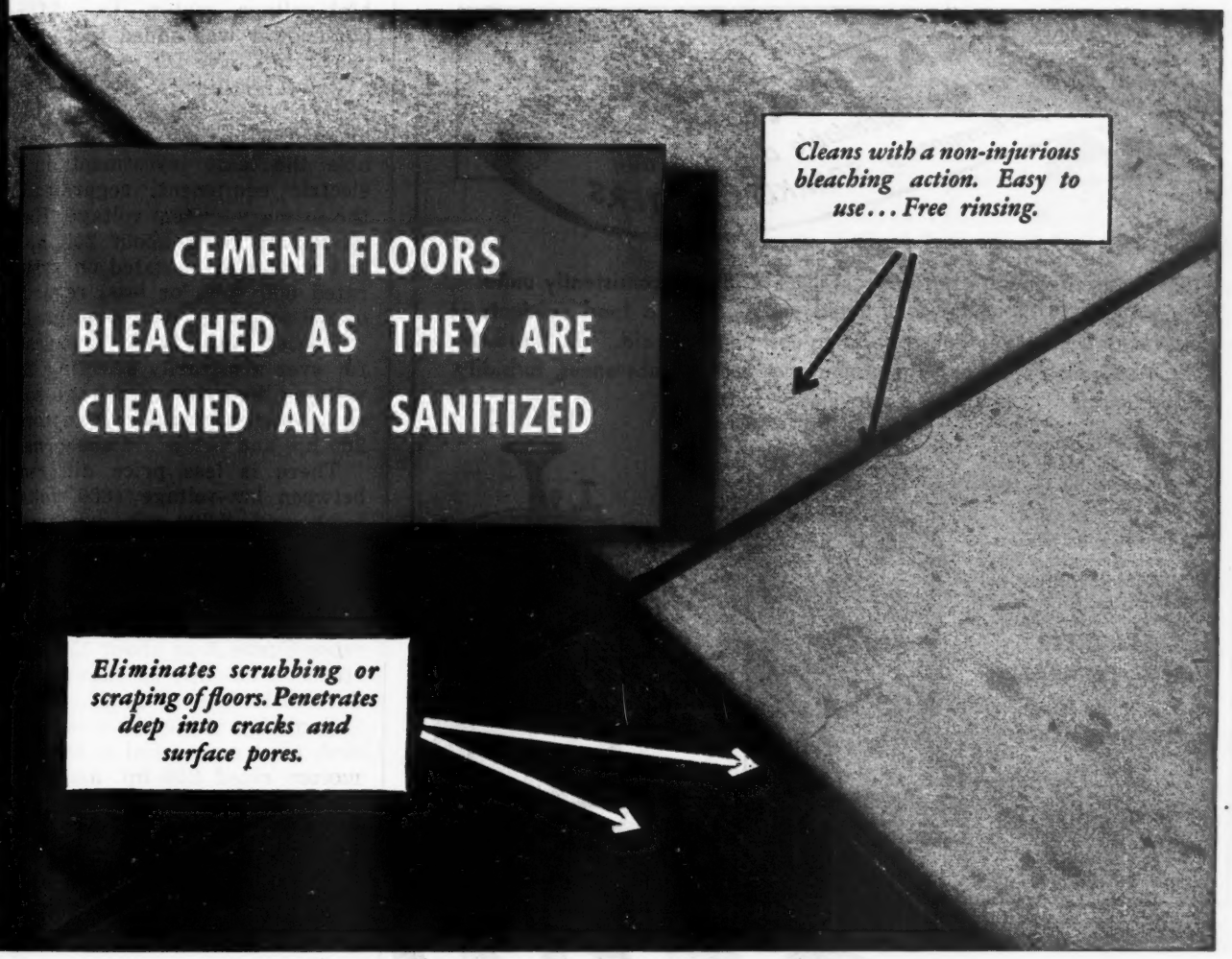
When selecting the primary voltage of the power-distribution system, it is necessary to consider more than just the prices of the motors and control which operate at primary voltage. The cost of the primary system must be considered.

In industrial plants with a total demand of a few thousand kva., the primary power system (i.e., the generating plant or main step-down substation from the utility system) and the primary switchgear and cable cost about $2 more per kva. for 2,400-volt primary voltage than for 4,160-volt primary voltage. This cost differential will increase to about $4 or $5 per kva. for systems of 10,000 kva. and larger.

Therefore, if a 2,400-volt system is arbitrarily chosen in place of a 4,160-volt system, the extra cost of the entire 2,400-volt over the entire 4,160-volt distribution system, plus the cost of 2,300-volt motors and control, must be compared with the cost of 4,000-volt motors and control for those motors which operate at primary voltage.

This comparison can be made by referring to Curves C and D in Fig. 1. These curves show that the 2,300-volt motors and control, plus the extra cost of the 2,400-volt power system, are more expensive than 4,000-volt motors and control.

The total *extra cost* of the entire 2,400-volt power system over a 4,000-volt power system has been included at $4 per horsepower of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Cleans with a non-injurious bleaching action. Easy to use... Free rinsing.
Eliminates scrubbing or scraping of floors. Penetrates deep into cracks and surface pores.

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rco modern chemistry has produced Aktiv a specialized cement floor aner that is exceptionally effective. t only does it speedily and thoroughly ulsify grease and oil, it penetrates ep into cracks and surface pores, dinarily uncleanable. The dirt comes the surface where cold water will sh it away without trace. But that's t all: Turco Aktiv also sanitizes as it ans, whitens cement with a non-urious bleaching action.

A granular material, Aktiv is safe d pleasant to use at all times. As it solves completely in water, it may be de into a stock solution for immedi- use. Or sprinkle on a wet floor and, a few minutes, lightly work into cks and rough spots with broom or sh, hose off or mop with clear water. rd scrubbing or scraping is eliminated.

Aktivating cement floors is very inexpensive. Let the Turco Field Service Man show you. Write today.

Other Specialized Turco Products for the Food Processing Industry

Blu-Fax, for light duty cleaning of floors, walls, and factory equipment.

Lustrite, for safely cleaning Linoleum, Composition and Rubber Tile.

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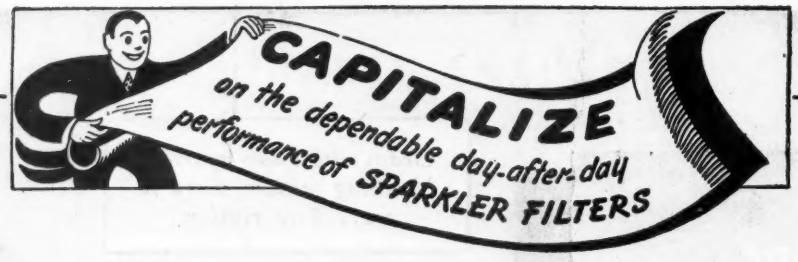

The design of the Sparkler horizontal plate insures consistently uniform, highest quality filtration of all liquid and semi-liquid food products at marvelous economy in time, operating cost and filter aid. The thoroughness with which Sparkler Filters remove all foreign substances, turbidity, refine, purify and renovate is a revelation to users.

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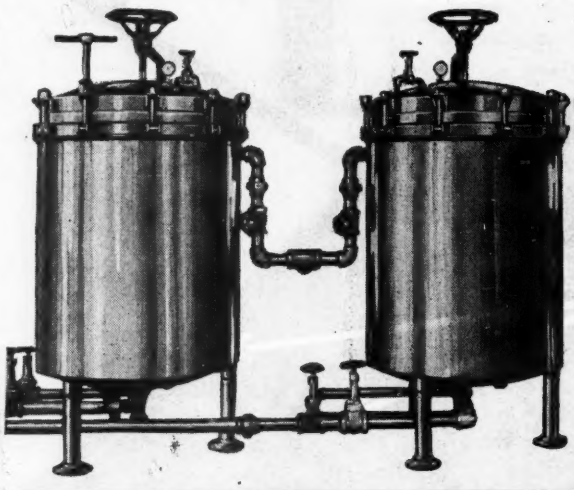

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high-voltage motor, i.e., $4 pe horsepower was added to Curve to obtain Curve D.

By referring to the curves i Fig. 1, it can be seen that belo about 175 hp., 440-volt motors en able the least investment in th electric equipment, regardless o the primary system voltage. Hence all motors rated about 200 hp. o less should be operated on system rated 600 volts or less, regardles of the primary voltage selected.

Hence, there is no justificatio for ever arbitrarily selecting 2,40 volts as the primary voltage so fa as any considerations of motors o 200 hp. and below are concerned.

There is less price differenti between low-voltage (600 volts o less) and 2,300-volt synchronou motors and control than there is be tween induction motors and contro for these voltages. This differen tial will tend to make Curve cross Curve A at about 150 hp. in stead of 175 hp., as shown for in duction motors (Fig. 1).

Summing it all up, it is, in gen eral, most economical to operate al motors rated 200 hp. and less o systems rated 600 volts or less, re gardless of the primary voltage Where a choice of primary voltag can be made, it is in most case more economical to select 4,16 volts rather than 2,400 volts.

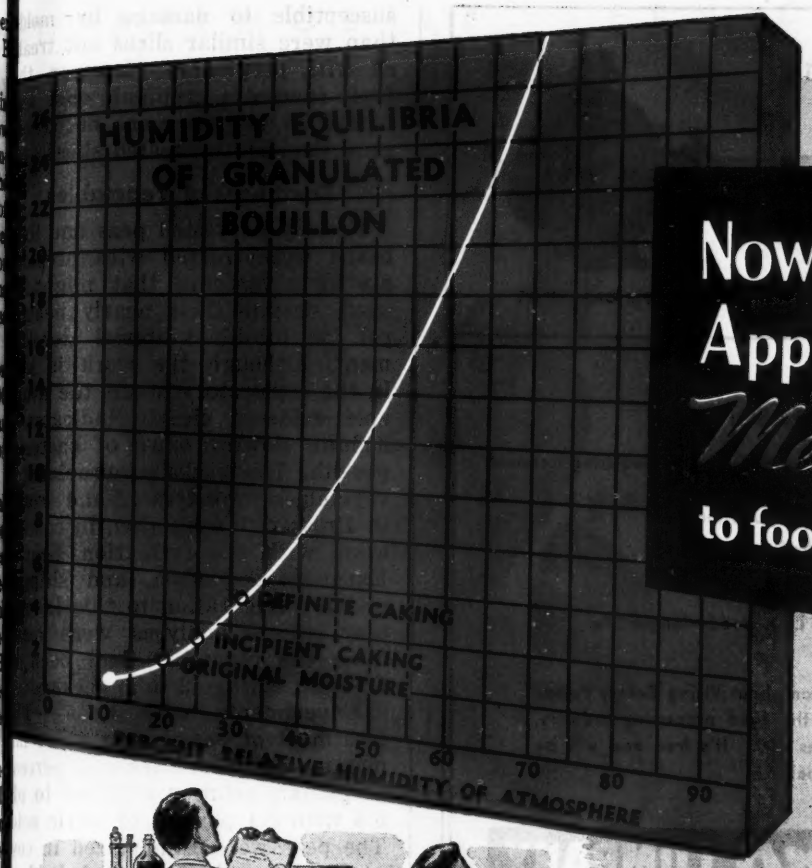
Propionates Control Microbial Growth

(*Continued from page* 74)

treatment, consisting of sprayin with enough of this solution to we the berries thoroughly, were ap plied.

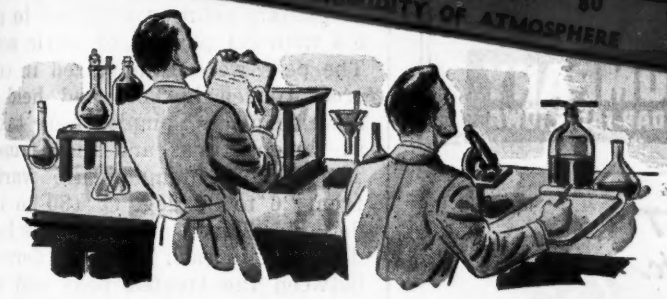
There appeared to be little differ ence in effectiveness between dip ping and spraying as indicated b growth of mold during the first tw days after treatment, althoug there was less leaching from be ries treated by spraying than fro fruit that had been dipped, and th sprayed fruit was firmer. The a dition of the wetting agent a peared to be slightly beneficial. Th experiments were, however, t limited in scope to be entirely co clusive. Use of solutions strong than 10 percent for dip treatme of berries does not appear to necessary.

When apple slices that had be sirup-blanched, cooled in 0.5 pe cent calcium propionate solutio and then frozen were defrosted a held for several days at room tem perature, they proved to be le

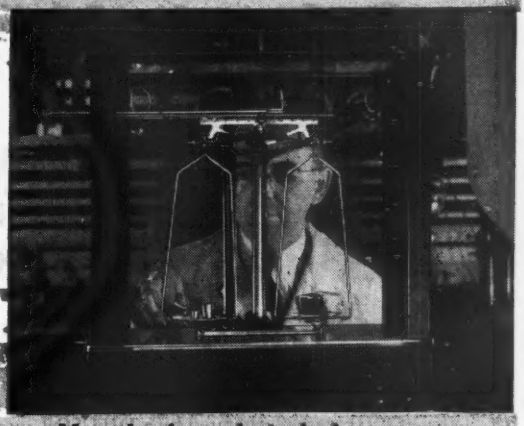


Now MARATHON Applies Scientific *Measurement* to food package protection

The humidity equilibria curve of a product that absorbs moisture rapidly in the lower ranges of humidity, and shows definite caking at a relative humidity of only 30%.



THE application of humidity equilibria studies to food packaging protection is another step pioneered by Marathon. Here is a thoroughly scientific approach to the problem of food packaging, applying a standard method of measurement of the kind and degree of protection needed to preserve product quality and flavor. This and other tests guide Marathon engineers in designing a package from the correct materials to maintain original product characteristics against all hazards of the factory-to-consumer journey. Marathon's scientific tests remove much of the guesswork from package building — first predetermining the protective demands of your product, then testing and retesting the package to make certain it meets your marketing requirements.



Marathon's technical departments are equipped with the finest laboratory instruments to provide complete facilities for scientific packaging studies.

MARATHON CORPORATION
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MARATHON

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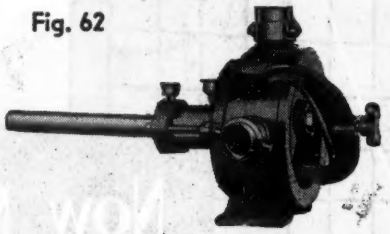
Has Completed 34 Years Building the Most Popular ROTARY PUMP On the Market

Fig. 62



5 - 10 - 20 - 30 - 50 GPM CAPACITIES

HERE ARE THE REASONS

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- Large sealing surface eliminates rapid slippage from wear.
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susceptible to damage by mold than were similar slices not treated with propionate. However, the fruit carried a propionic odor and tended to become more noticeably gray than did untreated slices.

Treatment of Vegetables

Freshly harvested peas and lima beans were treated with propionate as a measure that might be used, despite their nearly neutral pH, to inhibit bacterial development. Although the work is still in the exploratory stage, the available evidence clearly indicates a definite slowing down of bacterial growth. The packs of propionate vegetables were treated and frozen in Prosser, Washington, in cooperation with the Irrigation Branch Experiment Station, and shipped under refrigeration to this laboratory, where analyses were made after the vegetables had been in freezing storage 2 to 6 weeks.

Experiments with Peas — The treatment of peas consisted of immersion for 5 minutes in 5 percent propionate solution acidified to pH 6.3 with 0.1 percent of citric acid. The peas were then placed in covered wooden buckets and held in a warm place. Samples were taken at various times and then frozen. The holding temperature varied from 26 to 39 deg. C. (80 to 100 deg. F.). Three lots were thus handled, and in each lot the difference between the treated peas and the untreated control held for an equal period was striking. The control in each case was faded in color, very disagreeable in odor and very slimy. The treated lots showed but slight color change, no sliminess and little abnormal odor.

Since the work was done in the field where the supply of propionate was limited, two of the lots of peas were treated with the same sodium-propionate solution. Calcium propionate was used for the third experiment. Facilities were not available for determination of the bacterial content of the peas before freezing; however, counts after 1 month's storage at 0 deg. F. are given in Table IV.

The count of surviving bacteria in the peas treated with calcium propionate and held for 22 hours before freezing was about 34 percent of that of the untreated sample. For similar experiments with sodium propionate, counts of only 7 and 13 percent were found in the treated lots as compared with controls. This difference may have been due to one or both of two factors: lower effectiveness of ca

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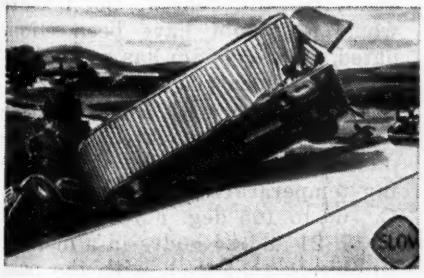
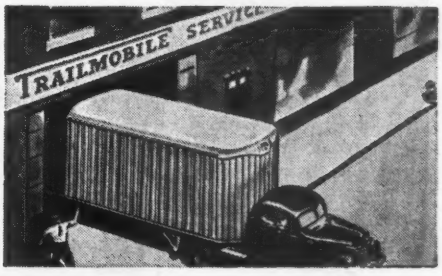
...his "bread basket's" in the ditch!

. . . exclaims Connie, at our Cleveland Branch. It's Buck Transfer calling—plenty urgent! The "bread basket" being one of their special-built trailers that haul six tons of bread and cake at a crack. An unavoidable accident had put the tractor and trailer out of commission.



We're in a Jam they tell Joe Young, our Branch Manager. The trailer's "washed out" . . . and we've got a tight schedule to meet—

Can You put it in running shape—fast? It sure looked impossible but we strip it down . . . and go to work—



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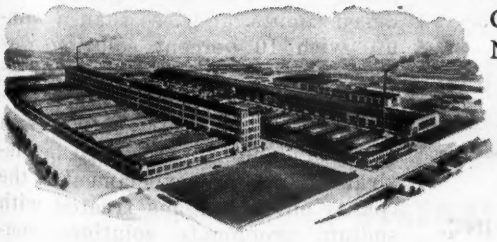

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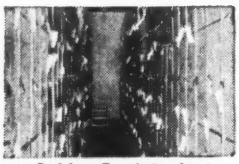
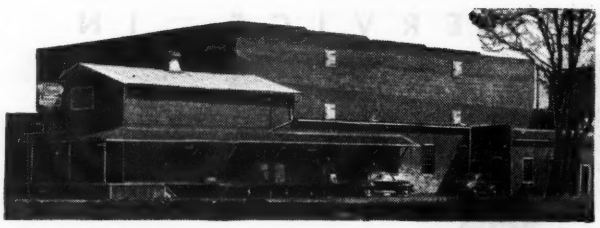
Fruit Storage


Refrig. Food Lockers

Frozen Food Storage

Chilling Meats



How this plant serves a town of 2500 as the Community Refrigeration Center

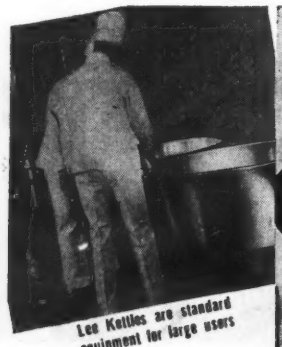
An ice plant of only 10 tons capacity a few years ago, the Greencastle (Pa.) Ice and Cold Storage now handles up to 80 tons daily, sells ice refrigerators, supplies farmers with ice for cooling milk, chills 600 tons of cherries in ice water before pitting, ices many refrigerator cars. ● It stores 100,000 bushels of apples, and freezes big hogsheads of peaches and berries, all from its own packing house. ● Meats, poultry, vegetables, and cream are frozen and stored. Twelve hundred refrigerated lockers are rented. ● Fresh-killed calves and sheep (4000 per month) are chilled before being shipped. ● The ice cream bar sells lunches; a cold room serves as a milk substation; beer was formerly handled at wholesale. Quick-freezing of locally grown foods in great quantity is the next step. ● We believe every progressive town can profit, in the postwar world, from a COMMUNITY REFRIGERATION CENTER. You are welcome to make use of the consulting-engineering service and equipment we offer for this program.

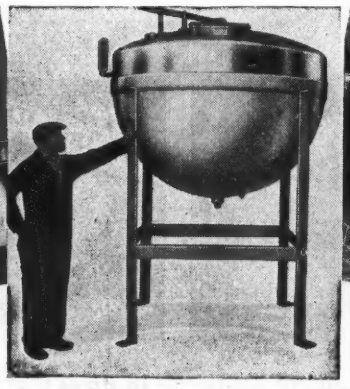
Frick Company, Waynesboro, Penna.

Milk Substation

Ice Delivery

Ice Cream Bar


Lee Kettles are standard equipment for large users



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Lee heavy duty two-thirds jacketed kettle

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416 PINE STREET PHILIPSBURG, PA.

cium propionate or the higher temperature—maximum 39 deg. C. (102 deg. F.)—to which the lot treated with calcium propionate was subjected. Experiments with lima beans (Table V) indicate that the elevated temperature probably caused the higher count. The quantitative difference in bacterial flora between the treated and control lots after 22 hours was no less noteworthy than the qualitative difference. Over 95 percent of the colonies from bacteria on treated peas were minute, subsurface colonies. Cultural tests of these organisms showed that they resembled *Lactobacillus plantarum*. Only about 30 percent of the colonies from bacteria on untreated peas had similar characteristics. The remaining organisms were largely Gram-negative rods, among which Achromobacter, Aerobacter and Flavobacter predominated.

A sample of peas was held for 4.5 hours after treatment with calcium propionate and then scalded and frozen. After a month of storage at —18 deg. C. (0 deg. F.), the peas were appraised subjectively by seven judges. Propionic flavor was not detected. The control had a slightly better skin texture and slightly poorer flavor than the propionated sample, but the differences were insignificant. Had they been treated with sodium propionate, the differences in texture would no doubt have been eliminated, since calcium has a toughening effect upon pea skins.

Experiments with Lima Beans—Lima beans were treated with propionate and then held at prevailing temperatures, 15.5 to 40.5 deg. C. (60 to 105 deg. F.) for periods of 17, 21 and 24 hours in a manner similar to that used with the peas (Table V). Samples were then frozen, and, in addition, samples were scalded and frozen for subjective appraisal.

The dipping in 5 percent sodium propionate solution definitely inhibited bacterial growth for a number of hours in lima beans, as in peas. In lima beans, one minute of treatment with a 5 percent propionate solution gave greatly reduced counts, and less than a minute with 10 percent solution was also effective. While it may be advantageous to acidify the propionate solution, acidification with citric acid did not prove to be desirable in our experiment; the counts on lima beans treated with sodium propionate solutions containing citric acid were somewhat higher than counts on the same lot

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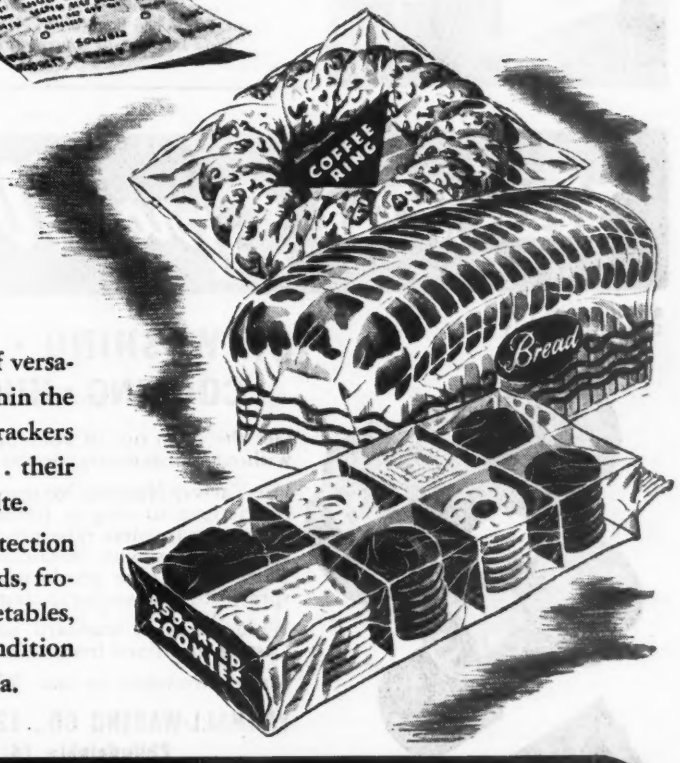

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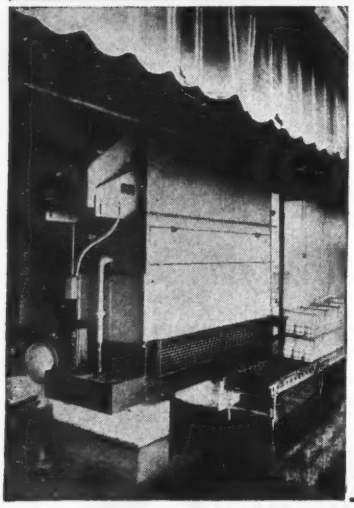

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treated with unacidified solutions. Temperature appears to influence the effectiveness of the sodium propionate treatment. The results of Experiment IV (Table V) show that the count of treated limas held 24 hours at temperatures not exceeding 25 deg. C. (77 deg. F.) was about 5 percent of the count of another portion of the same lot of beans held at temperatures that reached 40 deg. C (105 deg. F.).

Subjective appraisal of the scalded and frozen lima beans showed that the changes in consumer quality reflect to a great extent the changes in bacterial population. In the samples held for 24 hours at the higher temperatures prior to freezing, however, the treated samples, while still superior to the control lots, were no longer desirable.

Propionate should be used with due regard to its limitations, such as the pH of the product, its microbial flora, and the concentration of propionate likely to impart foreign flavor or odor to the food. The treatment should be used to maintain quality in sound material for a limited time; it will not improve inferior material. Propionate dipping of raw material to reduce deterioration due to microbial growth should in no way be objectionable, since commodities are later washed in the manufacturing process. On the other hand, incorporation of the salts in the finished product might be open to question, though they are now being used in bread and other bakery products. In the opinion of some, such use is not objectionable. Macy (1942) states that: "It is just as logical to retain the natural fine qualities of a wholesome food by the use of a mold inhibitor as it is to add salt, spices, wood smoke, vitamins, and so forth, to protect against undesirable changes or to provide factors which may be lacking in the foodstuff."

Summary

The inhibitory action of sodium propionate upon microorganisms varies with pH of the substrate, being greater in media of low than in those of higher pH. Concentrations that destroy some organisms at pH 3.5 to 4.5 may not retard their growth at pH 6 to 7. Preliminary evidence shows that under practical conditions sodium propionate significantly delays microbial spoilage in fresh figs and berries; it delays microbial spoilage in fresh lima beans and peas despite the more nearly neutral pH of the vegetables.

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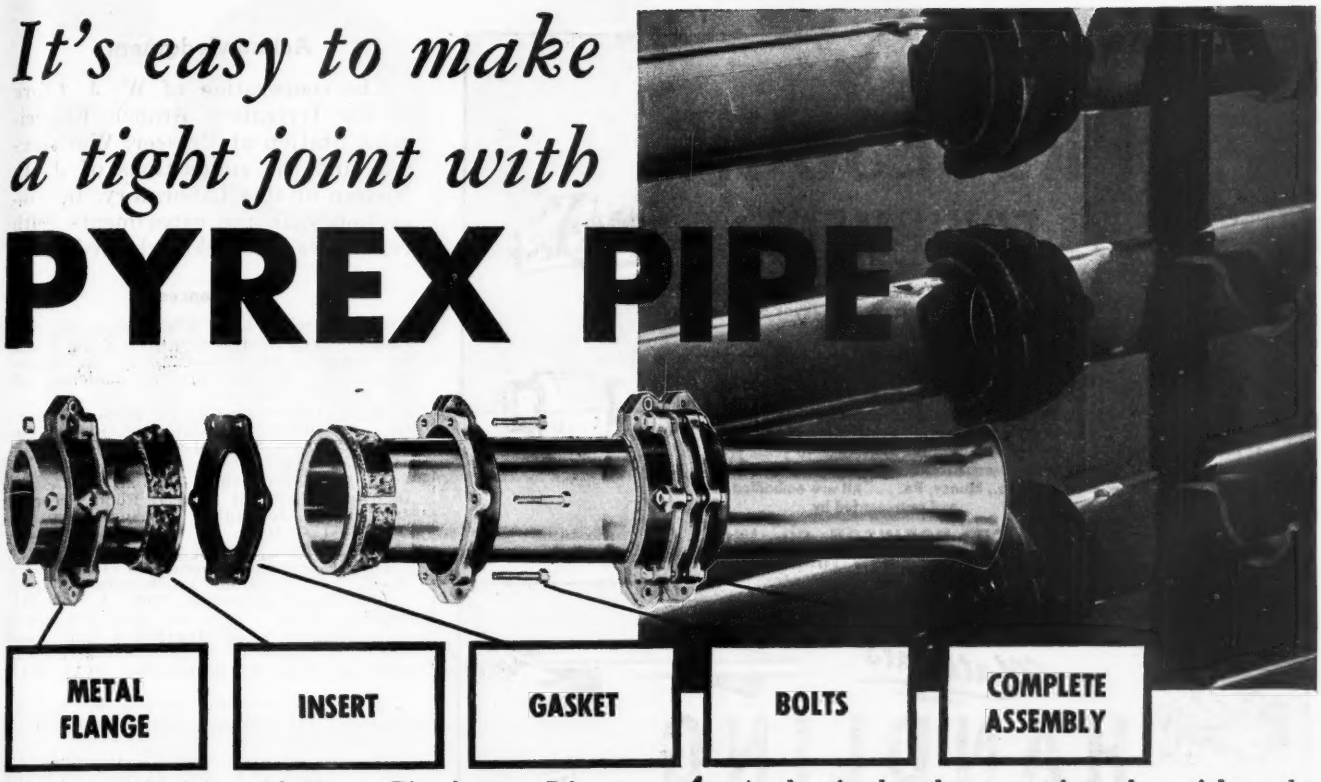

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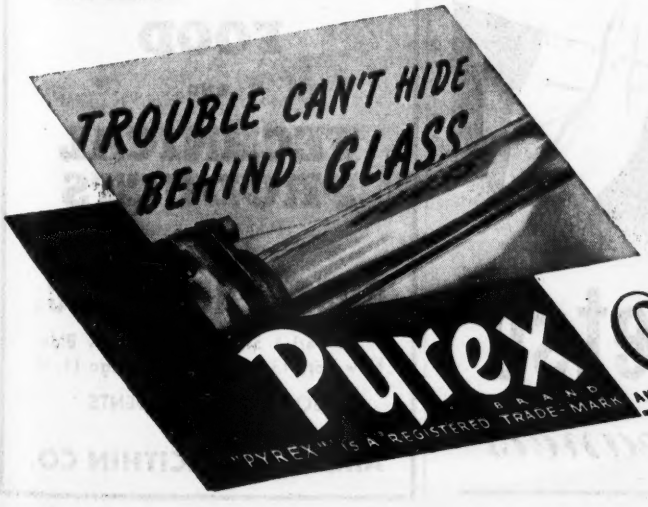

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Acknowledgment

The cooperation of W. J. Clore of the Irrigation Branch Experiment Station at Prosser, Washington, and the suggestions of J. P. Nielsen of this Laboratory, in connection with the experiments with vegetables, are acknowledged.

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